THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXIV. No. 1889.] LONDON, JULY 25, 1899. [51ST YEAR. PRICE 6d.

HEBBURN MAIN GAS COALS.

Yield of Gas per Ton . . 10,500 Cubic Feet.
Illuminating Power . . . 16·4 Candles.
Coke . . . . . 68 per Cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

The Wallsend & Hebburn Coal Company, Ltd.
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

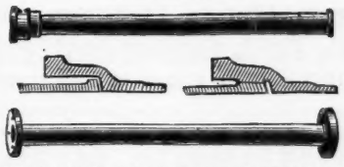
HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

GAS AND WATER PIPES

½ to 12 in. BORE.



THOMAS ALLAN & SONS,
Bonlea Foundry,
SOUTH STOCKTON-ON-TEES.
Formerly Springbank Iron-Works, Glasgow.
ESTABLISHED 1848.

ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

Telegrams: "BONLEA, STOCKTON-ON-TEES."

PARKER & LESTER,
Manufacturers & Contractors.

GAS-LEAK INDICATOR.

For Particulars and Price apply to
ORMSIDE STREET, LONDON, S.E.

ESTABLISHED 1830.

ROBERT MARSHALL;
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

NORTON'S PATENT
"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.

The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.

LE GRAND & SUTCLIFF,
HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

THE Utilization of Towns' Refuse for some practical purpose has been successfully solved; and there is, therefore, no reason why every township should not have its own Electric Light Installation, and obtain all the power from its Dust-Bins.

MELDRUM SIMPLEX DESTRUCTOR.

ORDERS NOW ON HAND—

DARWEN, LANCS., 8 cells; 2 Lancashire Boilers, 30 feet by 8 feet—200 lb. pressure.

SHIPLEY, YORKS., 4 cells; 1 Lancashire Boiler, 30 feet by 8 feet.

HUNSTANTON WATER-WORKS, BURTON, BLACKBURN, &c., &c.

At Hereford City the Sewage Farm is now worked entirely with power from refuse, 1¼ million gallons being pumped per day, besides working Sludge-Presses, Sludge-Pumps, and Lime-Mixers—the saving in Cost of Coal (not now used) being about £300 per annum.

Write for full Particulars, stating Weight of Refuse per annum, and for what purpose you would wish to use the Power, when we shall be glad to submit a suitable Scheme.

MELDRUM BROS., ATLANTIC WORKS, **MANCHESTER.**

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765).

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

Telegrams: "COCKEYS, FROME."

EDWARD COCKEY & SONS, LTD.,

Telegrams: "DAMPER, LONDON."

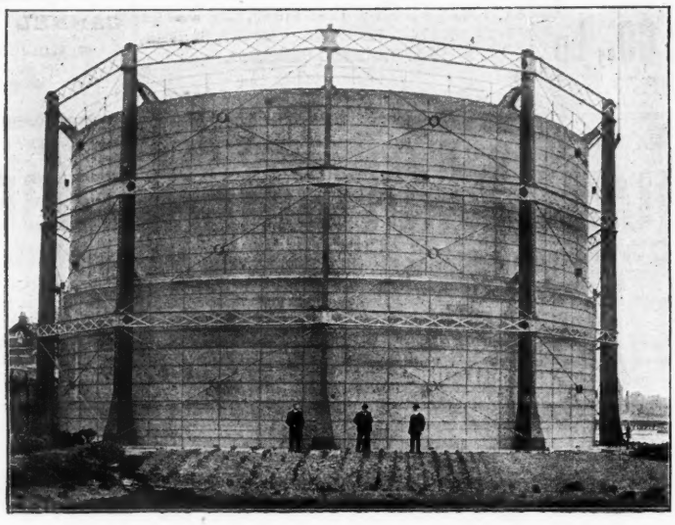
GASHOLDERS IN EITHER STEEL OR WROUGHT IRON.

GASHOLDER TANKS IN STEEL, WROUGHT OR CAST IRON.

CAST-IRON COLUMNS.

STEEL or WROUGHT IRON STANDARDS. *(Any Section.)*

INLET and OUTLET PIPES in either CAST or WROUGHT IRON, or STEEL.



HYDRAULIC MAINS.
FOUL MAINS.
CONDENSERS.
RETORT-LIDS.
PURIFIERS.
HYDRAULIC LIFTS.
ROOFS.
BOILERS in either WROUGHT IRON or STEEL.

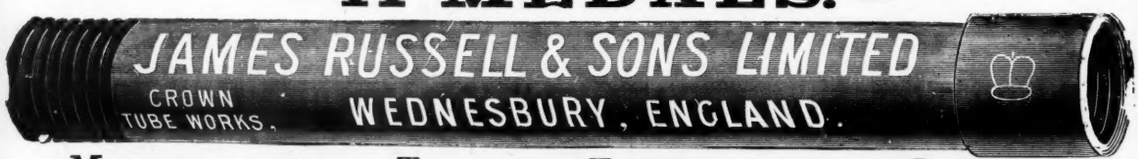
LAMP COLUMNS, MAIN PIPES, and IRREGULARS always in Stock.

THE IRON-WORKS, FROME, SOMERSET.

London Office: 181, QUEEN VICTORIA STREET, E.C. *BALE & HARDY, Agents.*

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

—11 MEDALS.—



MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

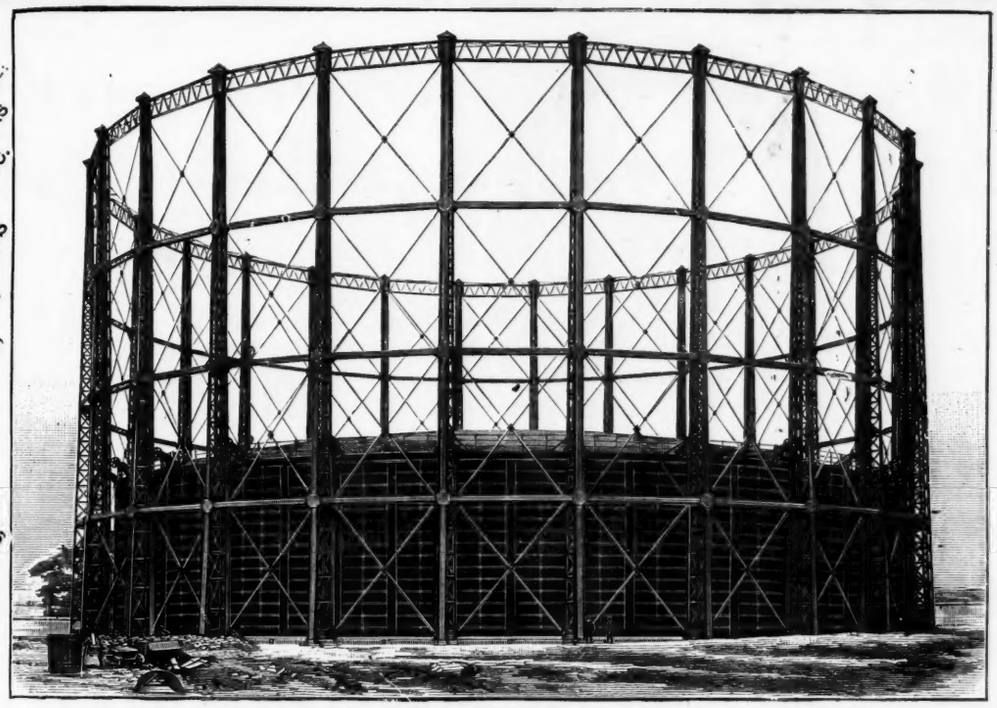
SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON: 108, Southwark Street. **MANCHESTER:** 33, King Street West. **BIRMINGHAM:** 114, Colmore Row. **LEEDS:** 6, Mark Lane, New Briggate.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS BIRMINGHAM

WELDED & RIVETED PIPES, FOUL MAINS, RETORT LIDS, WROT & CAST TANKS, PURIFIERS.

MANUFACTURERS OF

Humphreys & Glasgow's Patent Carburetted Water-Gas Plant.

INSTALLATIONS HAVE ALREADY BEEN SUPPLIED, AND ARE IN HAND FOR THE FOLLOWING GAS-WORKS:

COPENHAGEN
BELFAST
BRUSSELS
LIVERPOOL
TOTTENHAM
SWANSEA
MANCHESTER
BRIGHTON
PRESTON
SOUTHPORT
BATH
HOYLAKE
COVENTRY
WINCHESTER
SHANGHAI
STOCKPORT
NORWICH
LEA BRIDGE
STOCKTON-ON-TEES
EDINBURGH
GUILDFORD
BRENTFORD
COMMERCIAL GAS COMPANY
BRIDLINGTON
MIDDLESBROUGH
CROYDON
L. & N.W. RLY., CREWE
TAUNTON
ROTTERDAM
DORKING
G.L. & C. CO., BROMLEY
DURHAM
SCARBOROUGH
PERTH (W.A.)
BREMEN
MAIDENHEAD
EPSOM
NORTH MIDDLESEX
WANDSWORTH & PUTNEY
AARHUS
FALMOUTH
SOUTHAMPTON
HARTLEPOOL
UTRECHT
DEVENTER
PORTSMOUTH
BOURNEMOUTH
AYLESBURY
HAMBURG
DUBLIN
REDHILL

SECOND CONTRACTS.

COPENHAGEN
BELFAST
BRUSSELS
LIVERPOOL
TOTTENHAM
COVENTRY
LEA BRIDGE
COMMERCIAL GAS CO., POPLAR
Do. Do. WAPPING
G.L. & C. CO., NINE ELMS
Do. Do. BECKTON
BRIGHTON
STOCKPORT
CROYDON

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

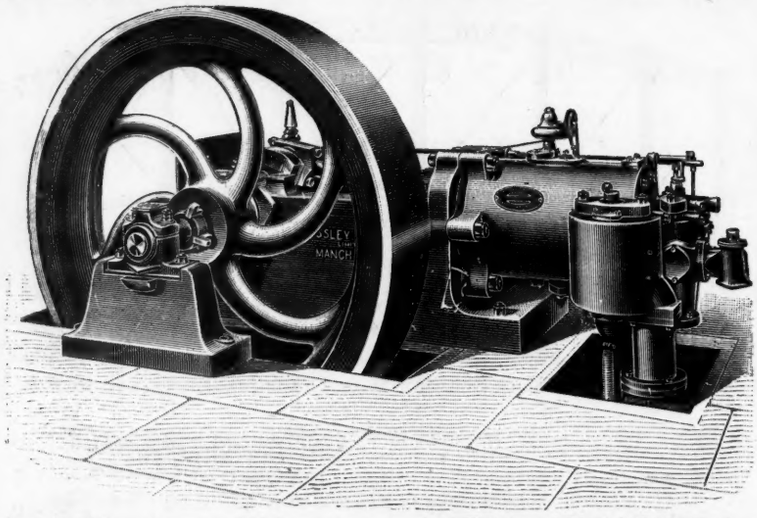
Midland and West of England District Office: 6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.

Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.

London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.

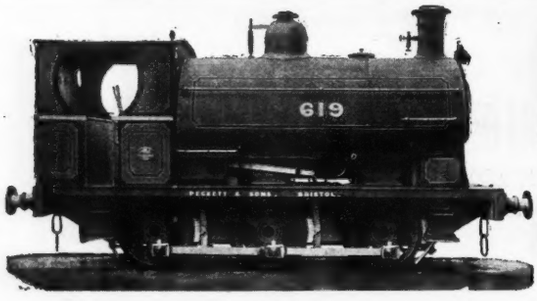
Telegraphic Address: "PARKER, LONDON."

CROSSLEY'S GAS-ENGINES



Represents 16-horse power and 20-horse power nominal High-Speed Electric Light Engines.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.



LOCOMOTIVES

LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for Immediate Delivery.

Photographs, Specifications, and Prices on Application.

PECKETT & SONS, Atlas Locomotive Works, BRISTOL.

Telegraphic Address: "PECKETT, BRISTOL."

NEWTON, CHAMBERS, & CO.,

LIMITED,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.

Established 1790

LONDON OFFICE: 19, Great George Street, WESTMINSTER.

Telegraphic Addresses: "NEWTON, SHEFFIELD," "ACCOLADE, LONDON."

GAS ENGINEERS, IRONFOUNDERS, & CONTRACTORS.

Manufacturers of every description of

PLANT, APPARATUS, and MACHINERY for GAS and CHEMICAL WORKS

RETORTS and FITTINGS, MOUTHPIECES with Self-Sealing Lids.

Improved COAL and COKE HANDLING PLANT, CONVEYORS, and ELEVATORS,

CONDENSERS, SCRUBBERS, and WASHERS.

PURIFIERS with Planed Joints a Speciality.

Patent CENTRE-VALVES, RACK and SCREW VALVES, WOOD GRIDS, and SCRUBBER-BOARDS, CAST-IRON MAINS, and SPECIALS.

STRUCTURAL WORK, COLUMNS, GIRDERS, and ROOFING.

GASHOLDERS, Cast-Iron or Steel Tanks.

DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (Special Quality) for Engine Cylinders. GAS COAL famous for its UNRIVALLED EXCELLENCE.

WELSBACH INCANDESCENT GAS-LIGHT.

NEW WELSBACH BURNERS.

25 Candles per Cubic Foot of Gas.

This is the Burner exhibited at Niagara Hall, London, and throughout the Provinces.

The New Welsbach Burner is used without a Chimney.

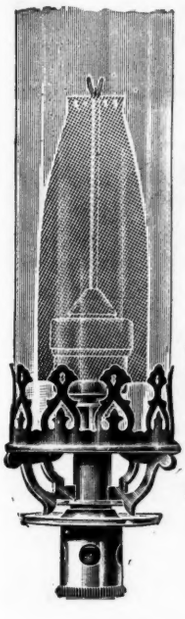
Suitable for Indoor and Outdoor Lighting

Supplied in SIX Sizes,

Consuming from $\frac{3}{4}$ to 7 Cubic Feet of Gas per Hour.

Price from 5/- upwards.

MANTLES from 9d. each.

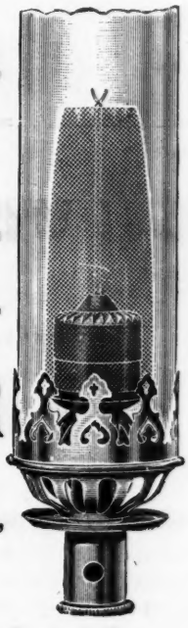


"C" WELSBACH BURNER.

REDUCED PRICES.

"C" Ordinary Burner, 5s. 0d.

"C" Bye-Pass Burner, 6s. 6d.



THE "YORK" WELSBACH BURNER

A CHEAP FORM OF THE "C" BURNER.

50 to 60 Candle Power with $3\frac{1}{2}$ to $3\frac{3}{4}$ Cubic Feet of Gas,

Price complete with MANTLE and CHIMNEY, **4/-.**

MANTLES FOR "YORK" BURNER, **1/-** EACH.

ALL THE ABOVE PATTERNS CAN NOW BE SUPPLIED.

Complete Price List on Application.

The Welsbach Incandescent Gas-Light Co., Ltd.,

York Street and Palmer Street, WESTMINSTER,

LONDON, S.W.

GIBBONS BROTHERS, LIMITED,

Telegraphic Address: "GIBBONS, DUDLEY."

DUDLEY,

Telephone: No. 8013.

GAS ENGINEERS, CONTRACTORS, RETORT SETTERS.

Patent REGENERATIVE SETTINGS,

GIBBONS & MASTERS' PATENT No. 1269, 1893.

SUITABLE FOR WORKS OF EVERY CAPACITY,

AND A SPECIAL FORM OF WHICH IS APPLICABLE TO

GASEOUS FIRING WITH A MINIMUM EXCAVATION.

RETORT-BENCH IRONWORK, CONDENSERS,

SCRUBBERS, PURIFIERS, VALVES, &c.

DESIGNS AND ESTIMATES ON APPLICATION.

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

OVER 60 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

Among the Companies supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **Seven Years.**

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas and Oils suitable for the Enrichment of Gas.

For Prices and full Particulars, apply to

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

Some of the Gas-Works and Local Authorities using Crosbie's Manufactures.

Aberdovey	Clitheroe
Abergavenny	Cobham
Airedale	Coleshill
Aldridge	Collingham
Alfreton	Colney Hatch
Antrim	Colombo
Armagh	Coventry
Ascot	Cranbrook
Audley	Cullen
Aylsham	Deddington
Ballymena	Dewsbury
Ballyshannon	Dover
Beaumaris	Downpatrick
Bentham	Droitwich
Bewdley	Durban
Biddulph	Dursley
Bideford	East Ardsley
Birmingham	Eastbourne
Blackburn	Elland
Blackwell	Ellesmere
Bognor	Ellstree
Bollington	Ennis
Boreham	Eye
Bournemouth	Farnham
Bradley Green	Felixstowe
Bramham	Flint
Brandon	Garn
Bridgnorth	Garston
Broadgreen	Garw
Broadstairs	Gillingham
Bromsgrove	Gorey
Broughty Ferry	Halesowen
Builth	Hanley
Burton	Hendon
Buxton	Hereford
Calne	Hinckley
Canncck	Holywood
Cape Town	Honiton
Carlow	Hoylake
Castleford	Huddersfield
Chester-le-Street	Huelva
Chesterton	Huntingdon
Chipping Wycombe	Hythe
Cleveland	Ilkeston
	Irthlingboro'

PAINTS FOR GAS-WORKS. PAINTS FOR GASHOLDERS.

Contractors to Her Majesty's Government, the Indian Government, the Natal Government, the Turkish Government, the Netherlands Railway, the London County Council, &c., &c.

CROSBIE'S PAINTS.

Guaranteed genuine and free from adulteration, and specially made to withstand Gaseous Fumes.

Catalogue and Testimonials on Application.

ADOLPHE CROSBIE, LTD.,

COLOUR WORKS, WOLVERHAMPTON.

Some of the Gas-Works and Local Authorities using Crosbie's Manufactures.

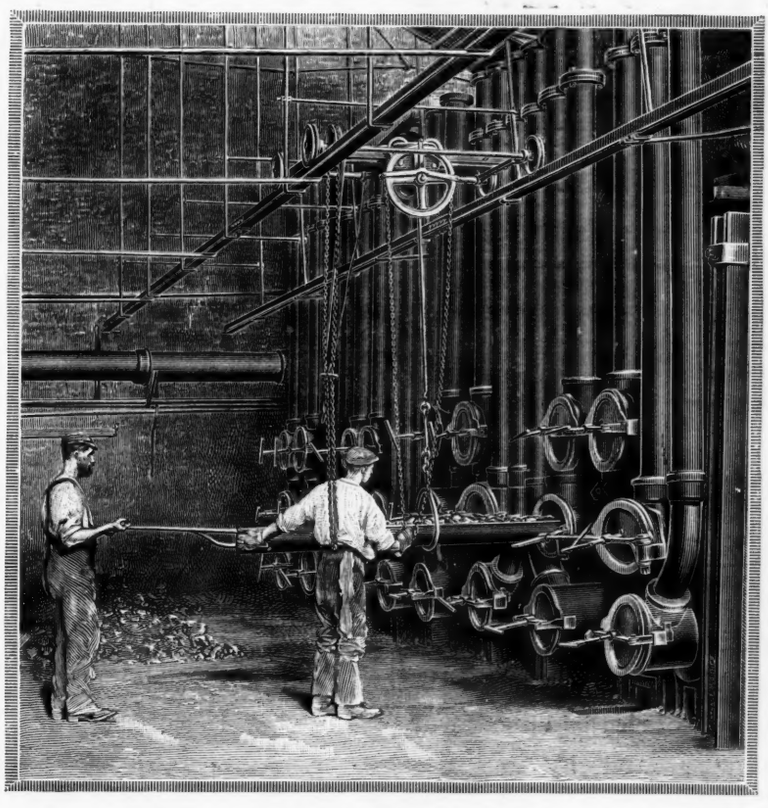
Johannesburg	Richmond
Kegworth	Rochester
Kildwick	Roscommon
Kilrush	Rugeley
Kineton	Sandgate
Kirkburton	Scarborough
Knutsford	Seaham Harbour
Leamington	Seisdon
Ledbury	Shifnal
Leek	Shipston-on-Stour
Leven, N.B.	Sidmouth
Limerick	Skibbereen
London	Slough
Loughborough	Southam
Lymington	Southend
Machynlleth	Stafford
Merthyr Tydfil	St. Albans
Milborne Port	Stamford
Minster	Storrington
Monte Video	Strood
Napier (N.Z.)	Stroud
New Mills	Sudbury
Newnham	Swinton
North Middlesex	Tetbury
Odiham	Tokio
Ogmore	Uppingham
Outlane	Uttoxeter
Parsonstown	Ventnor
Pembroke	Warwick
Penmaenmawr	Wexford
Pietermaritzburg	Wigston
Portadown	Willenhall
Port Elizabeth	Witney
Portrush	Wollaston
Portsmouth	Wolverhampton
Pwllheli	Workington
Ramsey	Wotton
Raunds	

BIGGS, WALL, & CO.,

THE "RAPID" MANUAL CHARGING APPARATUS.

Erected at the following Works:

EXETER, TRURO, REDRUTH, BASINGSTOKE, GRANTHAM, WORTHING.



4 CWT. CHARGE TAKES LESS THAN ONE MINUTE.

Telegraphic Address: 'Ragout, London.'

13, CROSS ST., FINSBURY, LONDON, E.C.

The above is an Illustration of the Machine as fixed at BASINGSTOKE, where it is giving unbounde satisfaction.

SAWER & PURVES, NELSON METER WORKS, MILES PLATTING, MANCHESTER,

(BRANCH OF METERS LIMITED),

MANUFACTURERS OF

IMPROVED WET GAS-METERS IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

IMPROVED DRY GAS-METERS.

Speciality: PATENT CASH PREPAYMENT METERS.

CATALOGUE SENT ON APPLICATION.

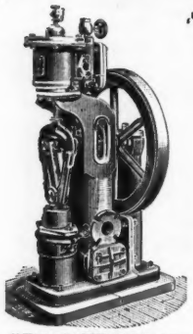
JOSEPH EVANS & SONS, CULWELL WORKS, WOLVERHAMPTON.

Telegrams: "EVANS, WOLVERHAMPTON." PLEASE APPLY FOR CATALOGUE No. 8. National Telephone No. 7089.

12,000 PUMPS IN STOCK AND PROGRESS.

TRADE MARK.

NO TAPPETS.



"Fig. 705. SINGLE RAM" STEAM-PUMP.

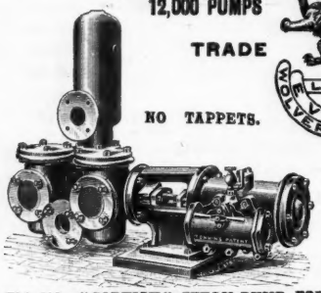


Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

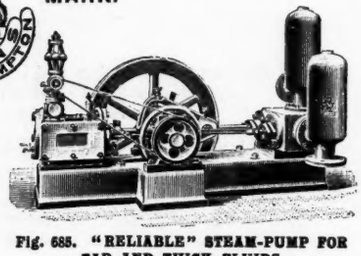


Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

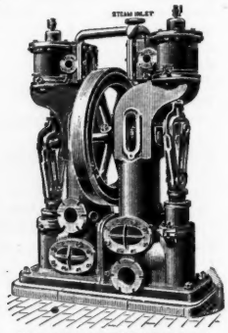


Fig. 712 "DOUBLE-RAM" STEAM-PUMP.

R. DEMPSTER & SONS, LD.

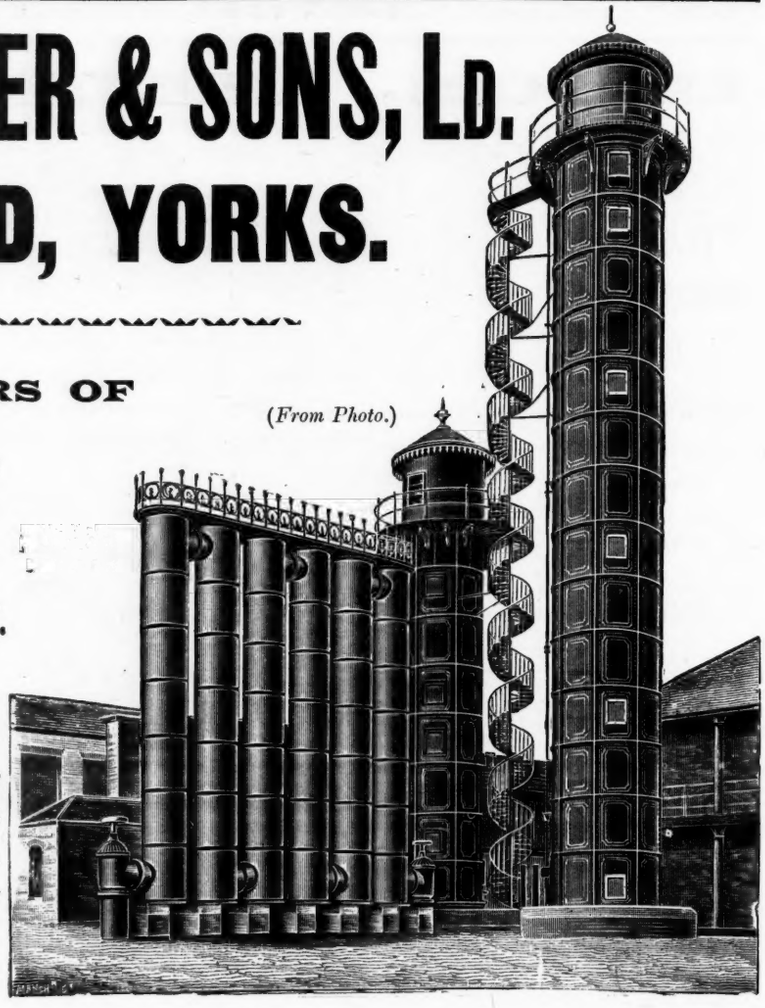
ELLAND, YORKS.

MANUFACTURERS OF

GAS PLANT

OF EVERY DESCRIPTION.

(*From Photo.*)



View illustrating Condensing and Scrubbing Plant erected for the Accrington Gas and Water Board by R. D. & Sons, Ltd.

C. HARRISON, Esq., Engineer.

WILLEY & CO.,

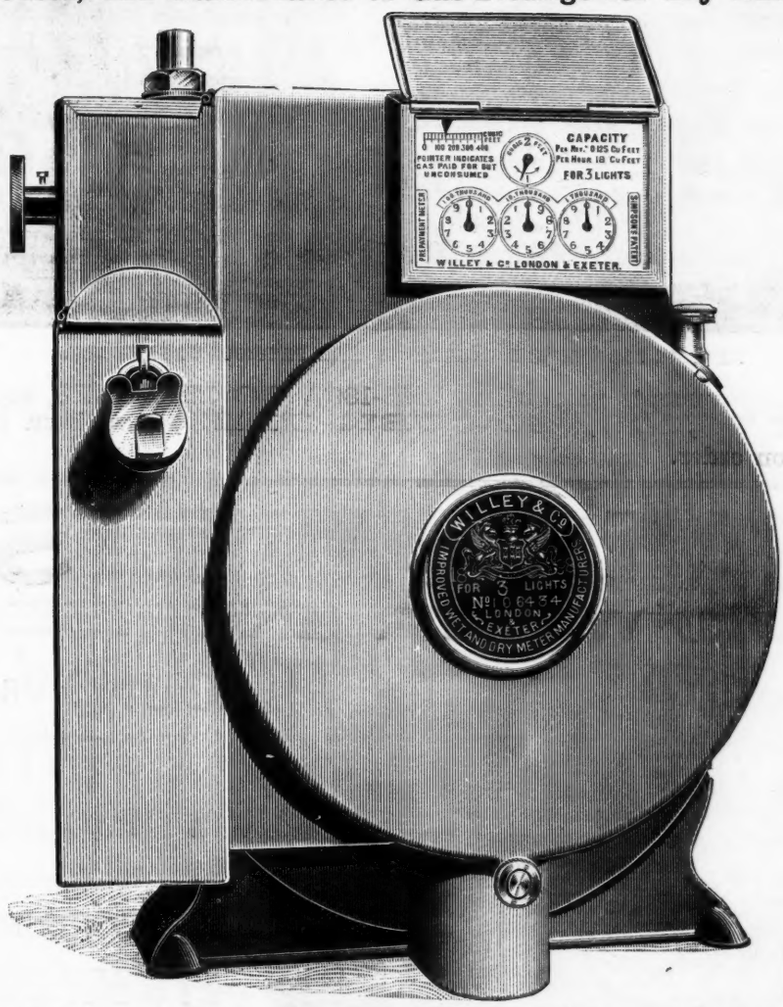
GAS ENGINEERS AND CONTRACTORS,

LONDON, EXETER, CARDIFF, MANCHESTER.

IMPROVED COIN METERS,

WET AND DRY.

Contracts entered into with Gas Companies for installing the System throughout, fitting up Houses, and maintenance of Gas-Fittings for any number of Years.



Strongest and Simplest Mechanism. Price definitely and instantly adjusted.
Absolute Accuracy. Works independently of Springs.
Special Device to prevent Tampering. Made for ½d., 1d., 6d., 1s., or any Coin.
Same Height as an ordinary Meter. Large Money-Box.

Guaranteed for Five Years.

POSTAL ADDRESS: EXETER.

Thousands of these Meters in use. Continuous supplies to the London and leading Provincial Companies, giving the greatest satisfaction. Gas Engineers may fix them with the confidence that they will give no trouble. Returns for readjustment average less than 1 per thousand.

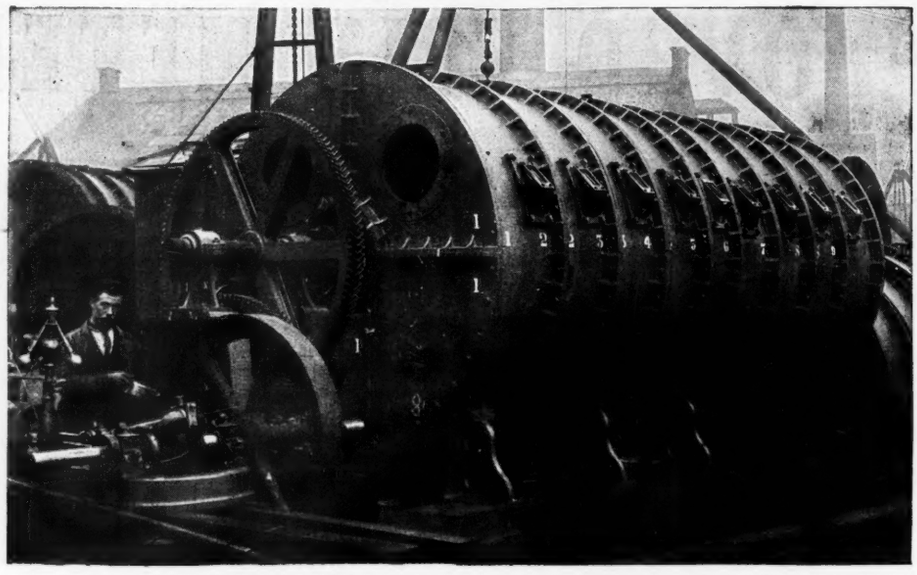
W. C. HOLMES & CO.'S

PATENT "NEW" SCRUBBER-WASHER

HORIZONTAL TYPE.

Machines of this and Vertical Type erected last year and now on order, equal to **51,720,000** cubic feet per diem.

Results guaranteed.



TELEGRAMS: "Ignitor, London." "Holmes, Huddersfield."

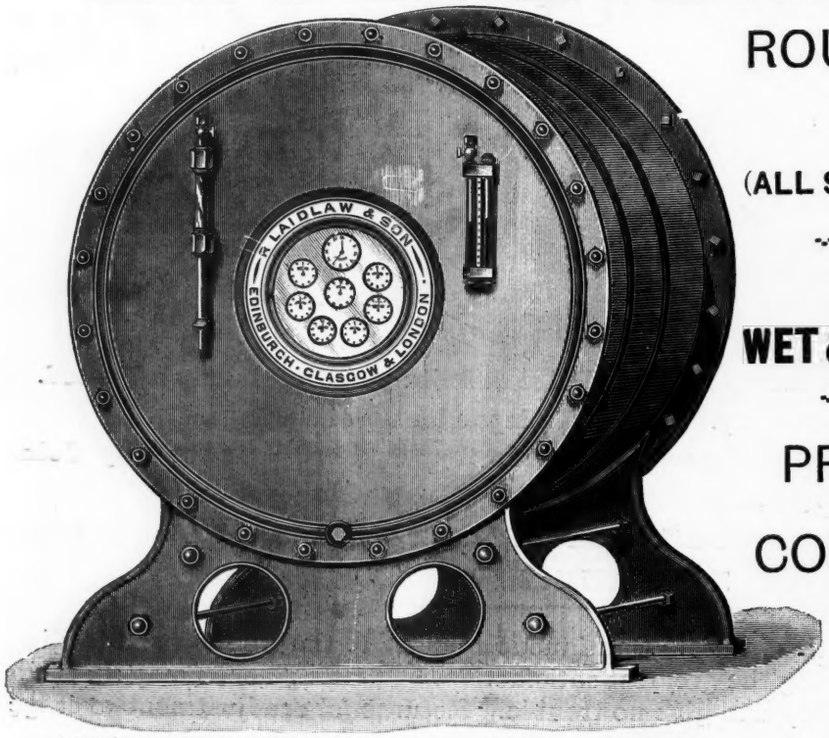
WORKS: HUDDERSFIELD.

MACHINE ERECTED AND WORKING IN YARD PREVIOUS TO SHIPMENT.

NOTE.—Since Improvements patented in 1895-1897, **68 MACHINES**, equal to a daily Capacity of **70,200,000 CUBIC FEET**, have been erected, or are at present on order.

R. LAIDLAW & SON

GAS & WATER ENGINEERS.



ROUND OR SQUARE STATION (ALL SIZES) METERS.

CONSUMERS'

WET & DRY GAS-METERS.

PREPAYMENT AND COMPENSATING METERS.

SIMON SQUARE WORKS, **EDINBURGH.** | ALLIANCE FOUNDRY, **GLASGOW.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

AMERICAN GAS OIL

SOLE IMPORTERS—

ANGLO-AMERICAN OIL COMPANY, LIMITED,

This well-known quality of Oil is used at most of the Corporation Works and Companies' Works throughout the United Kingdom. Contracts have also been entered into with several of the large Railway Companies.

LARGE STOCKS. PROMPT DELIVERY.

Stock of about 30,000 Tons is usually carried by us at our Installations at Avonmouth, Birkenhead, Barrow, Manchester, and London.

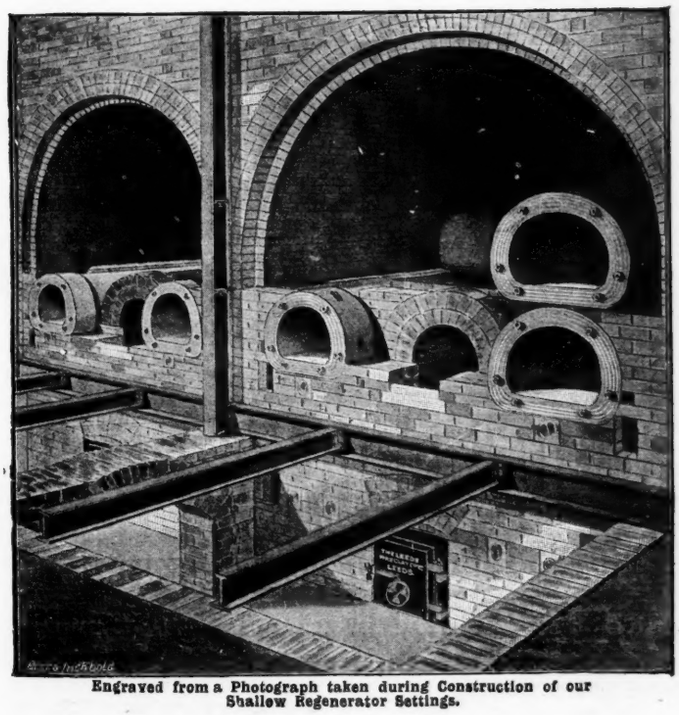
HEAD OFFICE:

22, BILLITER STREET, LONDON, E.C.

THE LEEDS FIRE-CLAY CO., LD., ENGINEERING DEPARTMENT

Telegrams: "SETTINGS, LEEDS." Telephone: No. 612.

WORTLEY, LEEDS.



Engraved from a Photograph taken during Construction of our Shallow Regenerator Settings.

RETORT-SETTINGS

OF EVERY DESCRIPTION

INCLINED, HORIZONTAL,

REGENERATOR, GENERATOR,

and DIRECT FIRED.

SHALLOW REGENERATORS A SPECIALITY

MANY INSTALLATIONS.

EXCELLENT RESULTS OBTAINED.

RETORTS RE-SET.

RETORT IRONWORK.

COAL AND COKE-BREAKING AND CONVEYING MACHINERY.

BUILDINGS, ROOFS, &c.

KIRKHAM, HULETT, & CHANDLER, LTD.,

PATENT "STANDARD" WASHER-SCRUBBER

Extracts ALL the Ammonia and a large proportion of the Sulphuretted Hydrogen and Carbonic Acid.

Old Pattern Machines fitted with latest Improvements at small cost.

Inspection and Estimates on Application.

PATENT "STANDARD" WASHER-SCRUBBERS in use and in hand now number over

580

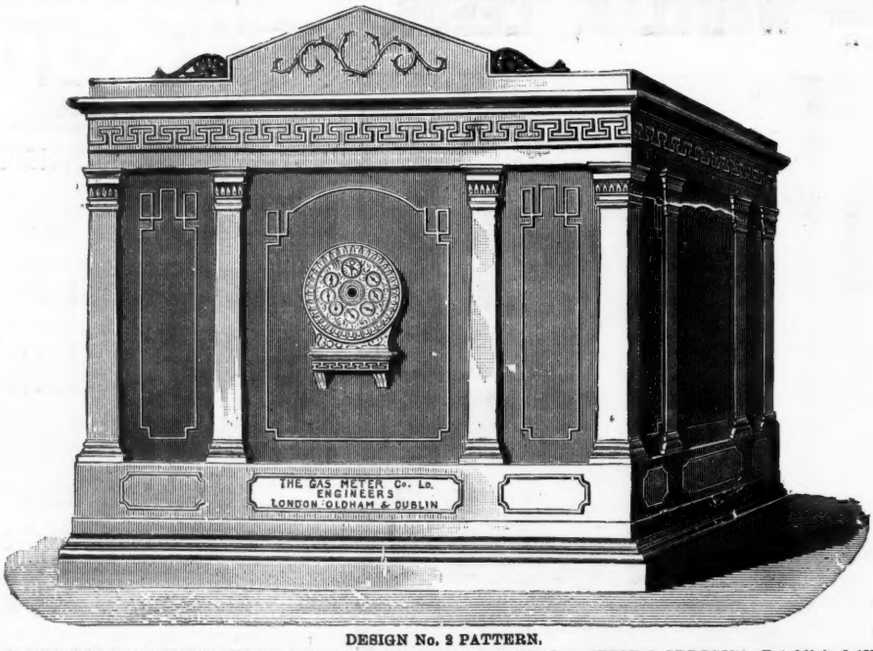
Address: 3 & 4, Palace Chambers, Bridge Street, Westminster, London, S.W.

THE GAS-METER COMPANY, LIMITED,

MANUFACTURERS OF

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.



STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM (Late WEST & GREGSON). Established 1820.

Prices and Particulars apply to

R. L. ANDREWS, General Manager.

Works: 238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

Telegraphic Address: "METER."

[See Advertisement on back of Wrapper.

ALEX. C. HUMPHREYS, M.E.
A. G. GLASGOW, M.E. } MM.Inst.C.E.

SINCE 1893

MESSRS. HUMPHREYS & GLASGOW

Have constructed or have in hand

CARBURETTED WATER-GAS PLANT

FOR THE FOLLOWING UNDERTAKINGS:—

American construction is instanced only when from the LONDON Designs of Messrs. Humphreys & Glasgow.

	Cub. Ft. Daily.
Copenhagen	700,000
Copenhagen (Second Contract)	2,500,000
Belfast	1,700,000
Belfast (Second Contract)	4,500,000
Brussels	700,000
Brussels (Second Contract)	700,000
Liverpool	3,500,000
Liverpool (Second Contract)	4,500,000
Tottenham	750,000
Tottenham (Second Contract)	750,000
Santiago de Cuba	400,000
Swansea	750,000
Manchester	3,000,000
Brighton	1,750,000
Preston	1,500,000
New York	1,200,000
Southport	750,000
Bath	1,000,000
Newburgh, N.Y.	350,000
Newburgh, N.Y. (Second Contract)	250,000
Hoylake	125,000
Coventry	600,000
Coventry (Second Contract)	600,000
Bordentown, N.J.	125,000
Winchester	200,000
Shanghai	225,000
Stockport	500,000
Norwich	1,000,000
Holyoke, Mass.	600,000
Lea Bridge	350,000
Lea Bridge (Second Contract)	350,000
Stockton-on-Tees	500,000
St. Joseph, Mo.	750,000
Edinburgh	2,000,000
Guildford	350,000
Brentford	1,200,000
Bridlington	125,000
Syracuse, N.Y.	850,000
Middlesbrough	1,250,000

	Cub. Ft. Daily
Commercial Gas Co.	850,000
Commercial (Second Contract)	850,000
Commercial (Third Contract)	1,250,000
Croydon	1,250,000
L. & N.W. Railway, Crewe	700,000
Taunton	225,000
Lawrence, Mass.	400,000
Rotterdam	850,000
Dorking	125,000
McKeesport, Pa.	500,000
The Gaslight and Coke Co., Bromley	3,750,000
The Gaslight and Coke Co., Nine Elms	2,750,000
Durham	200,000
New York (Remodelled)	11,000,000
Scarborough	800,000
Perth, W.A.	125,000
Bremen	550,000
Maidenhead	225,000
Epsom	225,000
North Middlesex	150,000
Wandsworth and Putney	1,800,000
Aarhus	800,000
Falmouth	150,000
Southampton	800,000
Hartlepool	750,000
Utrecht	1,000,000
Deventer	150,000
Portsmouth	1,000,000
Bournemouth	1,000,000
Aylesbury	150,000
Hamburg	1,750,000
Dublin	2,000,000
Redhill	275,000
Stockport (Second Contract)	500,000
Brighton (Second Contract)	1,750,000
Croydon (Second Contract)	625,000
Maidenhead (Second Contract)	225,000
The Gaslight and Coke Co., Beckton	2,250,000
The Gaslight and Coke Co., Fulham	1,750,000

The 1891 Installations of The Gaslight and Coke Co., 12,000,000 Cubic Feet Daily.

IN THE UNITED STATES, TO DEC. 31, 1898,

Messrs. Humphreys & Glasgow and their Colleagues The United Gas Improvement Company have jointly constructed 293 Sets of Humphreys Double-Superheater Apparatus (excluding earlier extensive construction of Single Superheater and "Combined" Apparatus) with a daily capacity of 219,550,000 cubic feet. **Of this volume, 56,875,000 cubic feet daily were undertaken during 1898.**

9, VICTORIA STREET, LONDON, S.W.

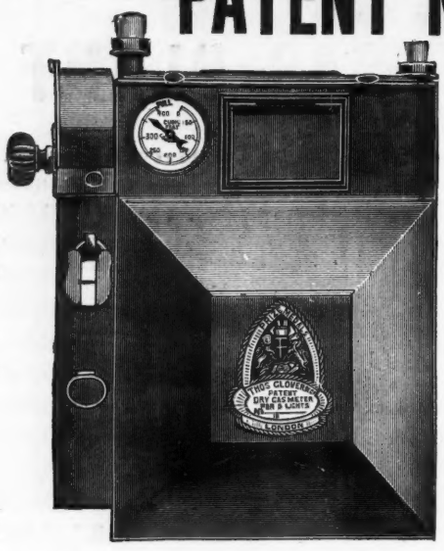
Telegrams: "EPISTOLARY, LONDON."

UNITED STATES OFFICE:

BANK OF COMMERCE BUILDING, NEW YORK.

THOMAS GLOVER & CO.'S

PATENT NEW IMPROVED PREPAYMENT METER



For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC, LONDON." Telephone No. 725, Holborn.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN, LONDON, E.C.

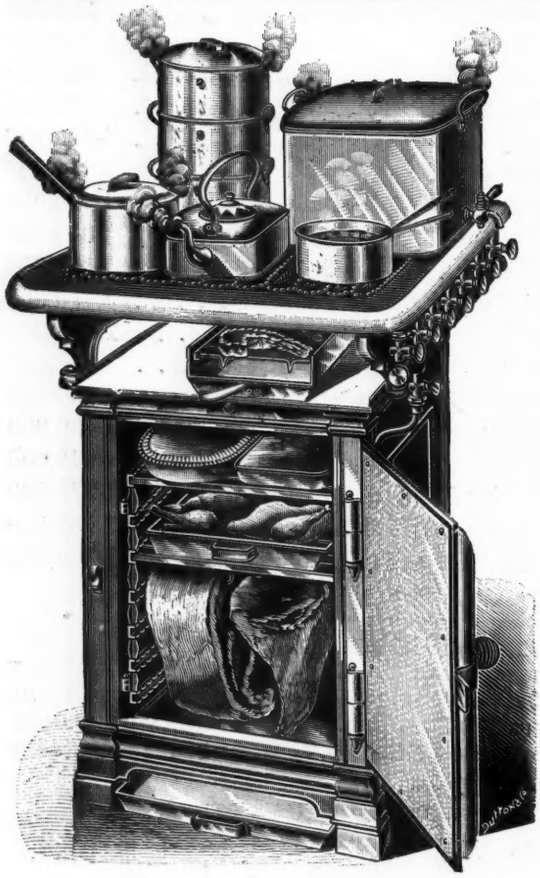
BRISTOL: 28, BATH STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 1005.

BIRMINGHAM: 1, OOZELLS STREET. *Telegraphic Address:* "GOTHIC."

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 3?95.

GLASGOW: ARGYLE WORKS, KINNING PARK. *Telegraphic Address:* "GASMAIN." Telephone No. 1525 South Side.

W. PARKINSON & CO.



THE PARKINSON

"Gold Medal" Gas-Cooker

IS UNEXCELLED.

Extra large Crown Plate, with Burners and Enamel, both Removable,

AND ALL THE LATEST IMPROVEMENTS.

SLOT COOKERS A SPECIALITY.

COTTAGE LANE WORKS, CITY ROAD, LONDON. Telegrams: "INDEX." Telephone No. 778, King's Cross.

BELL BARN ROAD WORKS, BIRMINGHAM. Telegrams: "GASMETERS." Telephone No. 1101.

[See also Advt. on last White Page.

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE.
The Westinghouse Experiment . . . 19
Is Birmingham Gas Dear? . . . 220
The Year's Work of the Sulphate of Ammonia Committee . . . 220
The Undulating Retort . . . 220
The State of Industrial Denmark . . . 220
Trade Union Federation . . . 220
Reports of Scientific Intelligence . . . 221
WATER AND SANITARY AFFAIRS—
The London County Council and the Water Question . . . 221
The Derwent Valley Water Bill Passed by the Lords' Committee . 222
THE PRIZE ESSAY ON SULPHATE OF AMMONIA:—
The Utility of Sulphate of Ammonia in Agriculture. By James Muir, M.R.A.C. . . . 223
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 227
Electric Lighting Memoranda . . . 227
Lights on Engineering Education . . . 228
Gas or Steam Heating . . . 229
Conditions of Labour in England . . . 230
Metropolitan Gas Charges Committee . . . 231
NOTES:—
The Depreciation of Machinery . . . 231
American Rules for Boiler Capacity . . . 231
Heat Absorption by Water Circulating in Tubes . . . 232
COMMUNICATED ARTICLE:—
Further Observations on Purification. By S. Carpenter, of East Ham . . . 232
TECHNICAL RECORD:—
Western (U.S.A.) Gas Association—Annual Meeting at Milwaukee 233
The Hastings Carburation Process . . . 235
Manchester and District Junior Gas Association . . . 235
Water-Gas Processes in Germany . . . 235
Injury to a Dam by Pressure of Ice . . . 236
Subways for Street Pipes . . . 237
REGISTER OF PATENTS:—
Incandescent Gas Lighting and Heating Devices—Ferron, C. A. . . 237
Scrubbing and Filtering Gas—Willis, W. G. . . . 237
Acetylene Generator—Kremer, J. . . . 238
Regulating the Flow and Pressure of Gas—Niel, A. . . . 238
Patent Notices . . . 238
CORRESPONDENCE:—
The Naphthalene Question . . . 239
Experience with the Hydraulic Main . . . 239
The Reported Explosion at the Beckton Chemical Works . . . 239
The Honley Gasholder Explosion . . . 239
PARLIAMENTARY INTELLIGENCE:—
Progress of Bills . . . 240
House of Commons Committee—Yeadon and Guiseley Gas Bill . 240
The Contest for the Derwent Watershed . . . 241
LEGAL INTELLIGENCE:—
Another Infringer of the Welsbach Patents Sent to Prison . . . 244
The Dangers of Electric Light Boxes . . . 244
MISCELLANEOUS:—
The Sulphate of Ammonia Committee—Second Annual Meeting . 244
Is Birmingham Gas Dear?—Article from the "Birmingham Post" 245
Meeting of the European Gas Company, Limited . . . 245
Incandescent Gas v. Electric Lighting for Newmarket . . . 246
Electric Lighting Notes . . . 247
New Chimneys for Incandescent Gas Lighting . . . 248
The London County Council and the Water Question—The Rejection of the East London Water Bill . . . 248
Leeds Corporation Water Supply—Completion of the Eccup Reservoir Embankment; the Past Year's Working and Profits . 249
The Water Supply of Stockport and the District . . . 249
Notes from Scotland . . . 250
Gas and Water Companies' Stock and Share List . . . 250
Current Sales of Gas Products . . . 252
Coal Trade Reports . . . 253
PARAGRAPHS:—
PERSONAL: Mr. Henry Dixon; Mr. D. H. Anderson; Mr. J. Byrom; Mr. Sydney Francis; Mr. Harry G. Edwards; Mr. Christopher Richmond; Mr. Frank Livesey . . . 231
Dr. Blake Odgers on "Local Government"—Gordon's "Compulsory Licences"—Institution of Gas Engineers—Calcium Carbide Factories in Norway—The Dividend of The Gaslight and Coke Company—The Prize Winners in the Examinations in "Gas Manufacture"—Testing Wire Ropes . . . 222
Extensions at the Rawmarsh Gas-Works . . . 238
Bingley and the Cullingworth Gas-Works . . . 244
The Assessment of the Blaenavon (Mon.) Gas-Works—Widnes and its Record—Lincoln Corporation Water-Works . . . 247
Leighton Buzzard Water Supp'y . . . 248
Gas v. Electric Lighting at Llanrwst—The Chester Corporation's Bill for Gas—Additional Storage for the Llandudno Gas-Works 249
Godalming Corporation and the Water-Works—Sales of Shares . 253
Skipton District Council and the Gas-Works—Hunstanton Gas Profits—Broadstairs Gas and Water Supply—Manchester Gas-Works Profits—C. & W. Walker, Limited—Penny-in-the-Slot-Machines—Cost of the Ilford Gas Bill—Hoylake and West Kirby Gas and Water Company, Limited—Reductions in Price—The Leeds Pipe-Layers and the Eight-Hour Day . . . 254
Sale of the Melbourn Gas-Works—Accidental Poisoning by Coal Gas—The Singapore Municipality and the Gas-Works—The Finances of the Darwen Corporation—Northampton Water Supply—Manchester Water Supply . . . 255
Increase in Price—Village Lighting by Acetylene—Seville Water-Works Company, Limited . . . 256

TO SUBSCRIBERS.

TERMS OF SUBSCRIPTION TO THE "JOURNAL."

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance.

If credit is taken, the charge is 25s. a year.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Second Half of the Year, are reminded that this can only be done during July.

WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

EDITORIAL NOTES.

The Westinghouse Experiment.

THE announcement of the intended establishment on the Manchester Ship Canal of a British offshoot of the Westinghouse Electric and Manufacturing Company, mentioned in last week's "JOURNAL," and actively circulated through the newspapers, is just one of those startling bits of news that catch the eye of "the man in the street," and inspire journalists with more or less sapient reflections on the course of trade developments at home and abroad. The proposal to employ a million-and-a-half of money to start in Manchester some new electrical and mechanical engineering works calculated to give emplcyment to 5000 men, is indeed a piece of news of the first order of importance, which might be discussed by the column without exhausting all its significance. The fact that the whole establishment will be essentially American, although worked with British capital and utilizing English raw material and labour, is just the piquant touch of novelty that takes the popular mind. There are scores—hundreds even—of native firms as big now as the British Westinghouse concern can ever become; but they do not greatly interest the multitude.

The attraction of the new venture for readers of the "JOURNAL" is of a special kind. The Westinghouse connection has largely increased of late years on the electrical side; but the establishment was originally founded to carry on mechanical engineering work in general. A contemporary points out that the British offshoot will have the benefit of all the accumulated experience gained by the Pittsburg house: "It is understood that the "parent company has spent many hundreds of thou- "sands of pounds on experiments, and that it still "devotes about a fourth of its profits to research work. "It has the best and most promising field in the world, "and it is difficult to conceive of any problem arising "in this country which could not be solved by the data "stored in the archives of Pittsburg." One of the problems which, it is now understood, has been definitely shelved at Pittsburg is that of the manufacture of a cheap and strong fuel gas. For some years Mr. Westinghouse was interested in this question of artificial fuel gas, only to find that coal and carburetted water gas are the only varieties of gaseous fuel that can be economically distributed to any distance from a central generating station. He failed to make, by any open cupola method involving the retention in the product of the atmospheric nitrogen, a cheaper article of the class which would pay to pipe off. The manufacture of gas-engines of the largest size is a Westinghouse speciality, together with cheap gas-meters for great quantities of gas; and many other appliances used in gas and water engineering. The fact of the Westinghouse people coming to England to make all these things on the spot may either mean that they have too much work at home to cultivate an export trade, or that the industrial facilities of this country are far from that stage of exhaustion of which some pessimists have spoken.

There is, however, an obvious explanation not only of the Westinghouse enterprise, but also of the German schemes of the same nature which are known to be hatching. The imminent conversion of most of the horse tramways of the United Kingdom to electrical traction means an enormous increase of mechanical engineering activity, which our engineering firms must prepare for or be stranded. There is practically no rival of the electric tram or light railway car. We are upon the brink of a great development of this means of transit, the upshot of which cannot be foretold. It is a fortunate circumstance that the British engineering employers were able to take the A.S.E. "out "of winding" before the pressure came on. If the British workman in the engineering trades has only learnt to turn a deaf ear to his whilom socialistic advisers, and is willing to make the best of his job, he has years of prosperity before him. There will be no question of amount of wages, so long as the work is well and quickly turned out of hand. It was to have been hoped at one time that the gas industry would take more than an indirect share in furthering these interesting trade developments. The gas tramcar, however, seems to be dropping behind. But there will be more gas used in lighting the shops where the electric cars and

machinery are made, if the advantages of modern improved lighting systems are fairly kept in evidence.

Is Birmingham Gas Dear?

In another column we reproduce a very creditable exercise in gas-supply criticism from the "Birmingham Post," on the suggestive query: "Is Birmingham Gas Dear?" The inquiry begins with the inevitable reference to Widnes, which has caused a great stir in the newspapers since the news of the last penny reduction started on the round of the Press. We do not propose to go into the question of Widnes gas and how it is that Mr. Isaac Carr can sell it at so cheap a price. The fact is greatly to his credit as it stands; and we congratulate him upon it, and Widnes upon him. All the world cannot burn Widnes gas, however; and it is but natural that, while popular newspapers in general airily commend this marvellously cheap article as a shining proof of the benefits of municipalized gas supply, those published in localities where municipalization still leaves gas at a price far above the lowest possible figure, should be exercised as to the rights of the matter. The comparison of gas accounts applying to different undertakings is a difficult proceeding to carry through in a proper and convincing manner. Even when carefully done, the result may shed no enlightenment on the character of a particular gas administration, unless the history of the undertaking itself for a significant period is also brought into the investigation. It will be perceived from these observations that it is not so easy as it looks to answer the question of whether or not any town's gas is "dear." Some towns' gas might be regarded as dear at any price; but this is not the present question. Perhaps it would be better to put it in another form, and ask: Is Birmingham (or any other) gas dearer than it might be? One famous economist taught that "the worth of anything "is just as much as it will bring." This is true, when the market is open and in a healthy condition. Where the market is not open to competition, the standard of value is a different one. If the seller can fix his own price, as with gas, the question of the reasonableness of the price remains debatable. In the case of gas, the data to be regarded in answering the question are always before the public. Everybody can obtain and use them, according to his ability. In the present example, Birmingham might have cheaper gas to-morrow if it would spare the undertaking the subsidies which it pays over to the district rates. Further than this, it is not expedient, for the time being, to carry the discussion.

The Year's Work of the Sulphate of Ammonia Committee.

The Sulphate of Ammonia Committee held their annual meeting of subscribers on Friday, when the Executive submitted a full tale of work done during the year. It would be unkind as well as useless to ask what share of the improved value of sulphate should be ascribed to the labours and outlay of the Committee. Suffice it to credit the Executive with the adequate discharge of the important function of all modern commercial organizations—suitable and persistent advertisement. Whether values rule high or low, trade is helped by judicious advertising. It is gratifying also to be able to felicitate the Committee on the initial success of their liberal policy in encouraging the collection and circulation of exact knowledge relating to the manurial value of sulphate. Their handsome prize offer attracted a good response; and there will be no doubt in the minds of readers of the winning essay by Mr. James Muir, which we are now publishing, that this excellent composition is deserving of the Judges' favour. The prizes offered by the Committee for the encouragement of users of sulphate of ammonia, through the National Agricultural Societies, also seem to be popular and highly effective. The absorption by the Committee of the old Association of Sulphate of Ammonia Manufacturers seems to have been chiefly a matter of form. On the whole, the conclusion of the Committee that their labours of the past twelvemonth have been attended with a large measure of success, appears to be justified. The subscribers have every reason to be satisfied with the actual and prospective state of affairs; and it is to be hoped that the Committee will continue to receive the support which they certainly deserve.

The Undulating Retort.

The intelligence that has appeared in our "Technical "Record" of late respecting the success of the so-called "undulating retort" of Messrs. Teissier and Nègre must have caused more than one English gas manager of mature age to open his eyes rather wider than usual, and to ask himself wherein lies the novelty of this shape of retort. Some of us remember a make of "ribbed retort" which was industriously pushed in this country during the later sixties. It may be of service to those of our readers who, like Mr. A. Allan, have "been there before," to point out that the distinguishing feature of the French corrugated retort is its thinness. The old "ribbed retort" was thicker where the ribs came than in the plain parts; and it is not shown by Mr. Allan that he thought of reducing the thickness of the fire-clay retort to 1·6 inches. Obviously, a ∩ retort 26 inches wide with a thickness of less than 2 inches must compare favourably, if it will stand wear and tear, with a 3-inch thick retort, to say nothing of the effect of the undulations in further increasing the heating surface. The fact—for it must be taken as proved on the evidence—that a recognizable and positive working advantage has been obtained by this modification of an old idea, is another illustration of the instruction that may sometimes be found in "looking backward." Mr. Allan's claim for priority over Messrs. Teissier and Nègre is good so far as it goes; but he fails to mention the grounds upon which he recommended his retort to the late Mr. John Somerville and to Mr. Fletcher W. Stevenson. The opinion of these critics that the hollows of the retort would fill up with carbon is just what any gas manager might have said; but it is an example of the "preconceived idea," all the same. Without pretending to offer a conclusive judgment on the question of patent right, which is not before us, we make bold to state that the French inventors have been very explicit in formulating their object, and have consequently established a claim based upon a distinct ground.

The State of Industrial Denmark.

The state of things in industrial Denmark, recently discussed in these columns by the light of a report published in "The "Times," has been put in a different aspect by Mr. F. D. Marshall's vigorous letter in last week's "Journal." We accept Mr. Marshall's correction of the original story, and wonder at the misrepresentation imposed on "The Times," which is usually so well informed on Labour topics. A later article in the "Daily Chronicle" seems to be merely a paraphrase of "The Times" narrative—of course, adopting the view that the action of the Danish employers was a challenge to a trial of strength between their Federation and the Trade Unions. The "Daily Chronicle" states that a local strike of joiners in a "town in Jutland led to a general lock-out of "joiners." It will be noticed that there is no explanation of the important words "led to," which, according to Mr. Marshall, cover the source of the mischief. Mr. Marshall says that the Joiners' Trade Union refused point-blank to abide by the decision of their own Federated Council, which refusal precipitated the masters' action. There is every appearance of probability about this version, besides Mr. Marshall's word for it. The incident recalls the similar recent trouble in the English shoemaking trade, visited by Lord James of Hereford with an exemplary fine upon the Union. This familiar difficulty of compelling organized Labour to keep its word, crops up in all manner of unsuspected places. It is reported, for instance, that the Amalgamated Society of Engineers are to be excluded from the forthcoming Trade Union Congress at Plymouth for indulging in the same trick with regard to a little blacksmiths' Society on the Tyne. There was a small strike "on principle" in a Newcastle shop; two men leaving their work as a protest against what they regarded as a trade wrong. Their places were filled by two members of the A.S.E.; and thereupon the matter was laid before the bigwigs of Unionism, who seem to have condemned both parties. The A.S.E. were advised to withdraw their members; but the Council of the Society refused to follow this advice. Whereupon the Trade Union Congress will exclude them. If this is what the higher organization of Labour means in practice, the future of industry is likely to be cloudy. The Trade Unions are fond of forming themselves into Federations, and they belong to Congresses which are greatly thought of by those who attend them. Unless all this organization is to fall into complete contempt, by one part of it obeying or repudiating the orders of the other at will, some effectual means of ensuring respect for these orders will have to be provided. A cash guarantee seems to be the only safeguard, so long as it lasts. If there had been something of the kind in Denmark, the existing dead-lock there would have been avoided.

Trade Union Federation.

The first meeting of the General Federation of Trade Unions was held at the Westminster Palace Hotel on

Wednesday last, to elect officers and transact other business. The object of this Federation, which is the outcome of the special Trade Union Congress held in January, is stated to be: "To uphold the rights of combination of "labour; to improve in every direction the general posi- "tion and status of the workers, by the inauguration of a "policy that shall secure to them the power to determine "the economic and social conditions under which they "shall work and live; to secure unity of action amongst "all Societies forming the Federation, the promotion of "industrial peace, and, by all amicable means—such as "conciliation, mediation, references, or by the establish- "ment of permanent boards—the prevention of strikes or "lock-outs between employers and workmen or disputes "between trades or organizations." Among the Societies constituting the Federation are the Amalgamated Engineers, the National Gas-Workers and General Labourers, and the Amalgamated Union of Gas-Workers, Brick-Makers, &c. The head office of the new Federation will be located in London; and Mr. Pete Curran, of the Gas-Workers' Union, was elected as Chairman for the ensuing year. If the Federation—with which are associated some of the more intelligent and moderate of the Labour leaders, as well as, unfortunately, some of the more notorious firebrands—really desire and will endeavour, by exercising a moderating and restraining influence upon the individual Societies composing it, to promote industrial peace and to prevent strikes, its formation would indeed be hailed with thanksgiving. But "the proof of the pudding," &c., and "the power to "determine the economic conditions under which they shall "work" has an ominous sound.

Reports of Scientific Intelligence.

Professor Barker, of the University of Pennsylvania, has been moved to complain of the inadequacy of English reports of matters of scientific interest both in the technical and the general Press. It appears that the learned Professor came to England, as a representative of American science, to attend the Stokes Jubilee at Cambridge and the Royal Institution Centenary. In connection with the latter, there were two commemorative lectures, by Lord Rayleigh and Professor Dewar respectively; and he was surprised and disappointed at the paucity of the reports of these discourses, which were briefly noticed in these columns at the time. "It was the first time in the world's experience that hydrogen, "the last of the gaseous substances remaining to us, had "been publicly shown in the liquid state, and utilized before "an audience as an instrument of research." True; and the next day's newspapers merely frivolled as usual about the talk in Parliament, a cricket match, and the Dreyfus affair! In America it would have been altogether different. Professor Barker darkly surmises that this suppression of scientific intelligence may be chargeable to the action of "autocrats in science who desire to exercise rigid censor- "ship upon the matter which may be given to the public, "and 'boycott' all discoveries which they do not see fit to "encourage." If this suspicion is correct, then it would seem that "the end of all genuine scientific progress in England "may be easily foreseen." It might have occurred to the worthy Professor that what he had seen at the Royal Institution was scarcely reconcilable with the idea that genuine scientific progress in England is in any immediate danger of interruption. The truth of the matter is not as Professor Barker artlessly supposes. The great British periodical Press does not report scientific papers or lectures except at one season, when there is little else doing; and that is when the annual meeting of the British Association turns the curiosity of the average newspaper reader towards scientific matters. While Parliament is in session, and the Courts of Justice are sitting, and there are horseraces to be run and Royal doings to be chronicled—to say nothing of foreign reports to be talked over—the ordinary daily newspaper cannot find room for "graphic" reports, in the American manner, about the liquefaction of hydrogen. We are not aware, by the way, that such events ever come to be reported at first hand in American newspapers; but it might be hinted that the success in America of the Keeley motor imposture does not say much for the quality of the scientific information spread by the American Press in the ordinary course. Periodical publications like the "Journal" exist primarily because the more ephemeral Press does not make any attempt to report everything that is said and done in most of the serious departments of human activity. All science and technic, labour and enterprise, has two aspects —the general and the specific. The former is illustrated by the flash of some new artificial light, which the wayfarer notices, with a passing wonder, as he goes along the busy street. If he wishes to learn more about it, he knows better than to look into the news paper. He must seek guidance of the specialized journals. But even these will not suffice for the earnest student, who must take the trouble to attend the meetings of the societies where novelties in science are minted. Thus it is by a roundabout road that knowledge circulates; but it ripens on the way.

WATER AND SANITARY AFFAIRS.

The last two meetings of the London County Council have been marked by an unusual display of jubilation over the London Water Question. On the 11th inst., the Council agreed, with but a few dissentient voices, to spend £3000 in preparing the weapons of war for next session; and last Tuesday they indulged in a little self-glorification at the success of their endeavours to bring about the rejection of the East London Water Bill. The reasons prompting them to this praiseworthy effort on behalf of the ratepayers were set forth with much detail in a report presented by the Parliamentary Committee, the principal portions of which will be found elsewhere. The Committee had six objections to the Bill; but as they can all be summed up in one sentence—that it was not wanted—there is no need to discuss them. Before the Lords' Committee, their Counsel made a strong appeal that the Bill should be thrown out; and he gained his case. However satisfied the Council as a whole might have been at their achievement, Mr. Beachcroft did not share the general feeling. He condemned the Council for their action in face of a possible scarcity of water owing to the then prevailing drought; and he moved that the report should be referred back to the Committee. Mr. H. P. Harris supported the proposition, and deprecated the invidious way in which the President of the Local Government Board and other members of the Government had been referred to as siding with the Directors of the Company. Mr. Cornwall, as Chairman, of course justified the action of the Committee. He said the Council had been too long "wearing the kid "gloves." Now, we suppose, they mean to take them off, and put on others more suitable for fighting purposes. He took credit to the Progressives for being anxious to settle the Water Question; but he was silent as to the desire evinced by some members of that party to "settle" the House of Lords, because just now it suits the Council's purpose to be thankful for the existence of that body, which, did occasion serve, they would declare to be effete. As may be judged by the indications already given of the temper of the Council, Mr. Beachcroft's proposition met with scant support, and the report was received.

The responsibility for the loss of the Bill is thrown by the Parliamentary Committee of the Council upon the Directors of the Water Company, who, they say, refused the terms offered them by the Council's parliamentary representative. The report gives one version of this part of the story; but there is another. If, as Mr. Beachcroft is reported to have stated, the condition of the withdrawal of opposition was the Company's support to the Council's Bill, we can well understand that the Directors would certainly not lend themselves to any proceeding of the kind. But whatever the offer really was, the Board doubtless had good and sufficient reasons for declining it, and refusing to have anything to do with Spring Gardens. They very wisely put their confidence in a far higher power—the Government, whose Intercommunication Act will be found a measure of immediate use. How long, it may be asked, would London have had to wait in order to obtain an intercommunication scheme at the hands of the County Council? Judging by a long report by the Water Committee which is upon the *agenda* for to-day's meeting, they are doubtful as to the efficiency of that scheme; and they have directed a letter to be addressed to the Local Government Board, suggesting that, as "considerable "anxiety has been shown by the public as to the present "position of the water supply," the Board might deem it advisable to make some announcement with regard to the effectiveness of the preparations that have been made.

In the course of Mr. Cornwall's remarks, he charged the Moderate party on the Council with thwarting the Progressives in their attempts to obtain possession of the water

supply, by finding excuses for the Water Companies. But in what respect does their conduct require excuse? Of late years, it is true, the East London Company's service has given rise to complaints on the part of the consumers. But who has been really responsible for the condition of things which justified these complaints? Surely, to a large extent, the body who, by their persistent opposition, delayed the execution of necessary works. It cannot be laid to the charge of the Company that they caused the exceptional drought of last summer; but the Progressives on the Council regard that visitation, by which large numbers of the poorer classes suffered much inconvenience, as a special "intervention of Providence" on their behalf. We cordially agree with the remark of a writer in "The Times," last week, that "this cynical "view of a widespread calamity throws an instruc- "tive light on their sham indignation and simulated "sympathy with the East-enders, whose misfortunes are "the trifling price exacted by Providence for assistance "kindly rendered to the politicians of Spring Gardens."

Possibly the Progressives regarded in a totally different light the similar visitation which reduced to a mere trickle some of the streams of their much-vaunted Wales. Of course, most people are now aware that the reports of the so-called "sufferings" of the poor at the East-end at the time referred to were greatly exaggerated. This was shown by a trustworthy authority when the matter was in everybody's mind; and it is now again confirmed by the Medical Officer of Health for the City of London—Dr. W. Sedgwick Saunders. In his annual report to the Corporation, he points out very plainly that the difficulties which arose in consequence of the enforced suspension of the constant service by the East London Company did not depend exclusively upon a diminished supply, but rather upon the absence of proper provision for the storage of the water, which was sent into the district at the rate of 24 gallons per head of the population. Dr. Sedgwick Saunders says that to apply the term "water famine" to a condition of things which allowed of this quantity of water—which is much in excess of that furnished to some of the most important towns in the Provinces—being delivered for consumption, is an absurdity. The seriousness of last summer's trouble was fully recognized by the Directors and officers of the East London Company, who did all they could to mitigate its severity. The steps they have since taken to prevent, if possible, its recurrence, cannot but be regarded by fair-minded critics as evidence of their desire to faithfully discharge the duties entrusted to them—a desire which there appears to be a much greater tendency in certain quarters to frustrate than to encourage.

When a leading member of the Parliamentary Bar characterizes a Bill as "one of the most interesting, and, as "regards parliamentary procedure, one of the most important, "which he recollected having been introduced," there must be ample justification for the use of such language. It was with such terms as these that Mr. Pope opened the case for the Derwent Valley Water Bill before the Committee of the House of Lords, presided over by the Earl of Lauderdale, on the 13th inst. Those of our readers who, by the aid of the condensed report which appeared in our columns, followed through the protracted inquiry in the Lower House the fortunes of the scheme embodied in the Bill, do not require to be informed at any length as to its nature. The watershed of the Derwent, which is estimated to yield every 24 hours some 33 million gallons—about 12½ million gallons less than the East London Company sent into their district every day last month—was coveted by the three Corporations of Derby, Leicester, and Sheffield. The Bills promoted by these bodies were consolidated into one; a fourth Corporation—Nottingham—was brought in; and provision was made for the formation of a Joint Board, consisting of representatives of these Corporations and the Derbyshire County Council, to supervise the area. The Bill came before their Lordships almost as an agreed measure; but all the parties interested were not satisfied. Under the Bill, Leicester and Nottingham offered to supply water to places within ten miles of their pipes; but the County Councils wished to have a supply reserved for them by the Board, although they were powerless to contribute to the cost of the works. Then the Chesterfield Rural District Council wished to have 15 gallons per head per day allotted to them, instead of 12½ gallons; and a millowner was opposing on the question of compensation. These matters were not of any great magnitude, and were not very difficult to adjust. In the result, as will be seen from the report in another column, the Committee gave Nottinghamshire a million gallons of water per day instead of the two millions asked, to be taken *pro ratâ* from the 28 millions allocated to the promoting Corporations; and the remaining 5 millions go to the county of Derby. The share of Nottinghamshire will cease in 1930. Their Lordships did not see their way to granting the request of the Chesterfield Rural District Council to raise their quantity of water per head; but they made a verbal alteration in the clause which rather improves the position. With regard to the millowner, an arbitration clause was inserted for his protection. Thus far things went fairly satisfactorily. But there was, in addition, a report from the Local Government Board, which, though coming before the Committee after the settlement of the clauses, really touched a point in the preamble. However, the Committee passed the Bill, leaving the report to be dealt with by Lord Morley as he may think best. The Bill will go safely through its remaining stages, and when it emerges as an Act it will represent the results of one of the sharpest contests of recent sessions in this particular department of legislation.

Dr. Blake Odgers on "Local Government."—We have received from Messrs. Macmillan and Co., Limited, the substance of six lectures which Dr. Blake Odgers, the Recorder of Winchester, delivered in the Middle Temple Hall in Michaelmas Term last year, and which they have lately issued in book form.

Gordon's "Compulsory Licences."—We have received from Messrs. Stevens and Sons, Limited, a copy of the above-named book, which is intended to supply a compendium of the law and practice relating to the compulsory licensing of patent rights under the Board of Trade. It is the first attempt made to deal with this subject.

Institution of Gas Engineers.—A circular has been issued to the members notifying a modification of the original plan of the Autumn Meeting. It is now stated that ladies will be welcome, though they will not be included in official visits, &c. We have been asked to remind members that they will greatly assist the Executive in making the final arrangements, if they will notify the Secretary as early as possible whether they intend being present at the meeting, and also whether they will be accompanied by ladies.

Calcium Carbide Factories in Norway.—According to a dispatch received from Her Majesty's Consul-General at Christiania, two calcium carbide factories have started in Norway. The larger, of 3000-horse power, is situated near Hafslund; the smaller, of 1500-horse power, near Borregaard, facing each other on either side of the Sarpfoss water-fall, above Fredrikstad. It is stated that the Hafslund factory is shortly to be increased to 5000-horse power. It was expected that in July or August, a third factory in Meraker, of 1500-horse power, was to be opened; and next year one in Kinservik, of 3600-horse power.

The Dividend of The Gaslight and Coke Company.—We learn from the Secretary and General Manager of The Gaslight and Coke Company, Mr. John W. Field, that the accounts for the half year ending June 30 show that (subject to audit) the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the statutory rate of £4 18s. per cent. per annum, carrying forward a balance of £139,557 19s. This is equivalent to 12¼ per cent. per annum on the old ordinary stock—the rate paid for the year 1898. This time last year, the balance carried forward was only £51,855; and in January it was £53,759.

The Prize Winners in the Examinations in "Gas Manufacture."—In the "JOURNAL" last week we published the list of successful candidates in the last examinations in "Gas Manufacture" conducted by the City and Guilds of London Institute. We are now able, through the courtesy of the Examiner (Mr. Alfred Colson, of Leicester), to give the names of the prize winners. They are as follows: Honours Grade.—First prize (£2 and a silver medal), H. D. Madden; second prize (£2 and a bronze medal), H. R. S. Williams. Ordinary Grade.—First prize (£1 and a silver medal), R. Nelson; second prize (£1 and a bronze medal), F. W. Goodenough; third prize (a bronze medal), D. J. Winslow. The money prizes are provided by grants from the Salters' Company.

Testing Wire Ropes.—Professor Warren recently tested at Sydney some flexible steel-wire rope supplied to the Government for bridge-lifting purposes. A piece 10 feet long was cut from one of the ropes, and its breaking strain ascertained under hydraulic pressure. The ropes are 4½ inches in circumference, are made in six strands of 37 wires each, and weigh 19 lbs. to the fathom. They are guaranteed to bear a load of 60 tons each, and the piece tested more than satisfied the guarantee. The first wire did not break until a pressure of 66 tons was exerted, and the whole rope only failing at 70¼ tons. As the movable sections of the bridges weigh about 35 tons each, and are to be raised by four ropes, the Government have a good margin on the side of safety.

THE PRIZE ESSAY ON SULPHATE OF AMMONIA.

THE UTILITY OF SULPHATE OF AMMONIA IN AGRICULTURE.

By James Muir, M.R.A.C.

(*Continued from p.* 168.)

Influence of Climate and Season on the Effect of Sulphate.

The many conditions affecting nitrification, and the influence which the rate of nitrification must obviously have on the waste of nitrogen applied as sulphate of ammonia, suggest that some seasons and climates must be more suitable for this manure than others. In this connection, it is interesting to compare sulphate of ammonia and nitrate of soda. The former is rather the less soluble, and requires to undergo nitrification before it is liable to be washed out of the soil. Nitrate, on the other hand, is always subject to loss by drainage. Therefore we find in practice that sulphate of ammonia usually gives better results than nitrate of soda in a wet season, but in a dry one it is likely to remain inert in the soil, and therefore to have a relatively worse effect. As will be shown later on, in the latter case part of the unused manure may be recovered in subsequent crops.

Wet climates and wet seasons are therefore favourable to sulphate of ammonia; dry climates and seasons, to nitrate of soda. An example of this with regard to season is afforded by the Woburn wheat experiments. The following table shows the produce per acre of corn and straw in each year in which the rainfall of the growing season (April to September) was 2 inches or more either above or below the average.*

Table VIII.

Year.	Rainfall, April to September.	Ammonia Salts.				Nitrate of Soda.			
		Corn.	Straw.			Corn.	Straw.		
		Bush.	Cwt.	Qrs.	Lbs.	Bush.	Cwt.	Qrs.	Lbs.
1878	Above average.	16·7	21	1	16	11·9	19	2	0
1879	,, ,,	14·7	20	2	22	12·0	19	1	21
1882	,, ,,	32·0	31	2	22	26·0	32	0	22
1885	,, ,,	31·2	25	2	10	28·1	28	0	21
1889	,, ,,	26·3	26	1	27	18·9	23	0	2
1884	Below average.	40·3	35	1	22	31·9	29	3	10
1887	,, ,,	26·1	22	1	14	35·0	29	0	10
1890	,, ,,	24·7	19	2	15	31·2	26	3	14
Average of wet seasons		24·2	25	0	19	19·4	24	1	24
Average of dry seasons		30·4	25	3	8	32·7	28	2	11

This shows that while in the dry seasons (in the dry climate of Woburn, be it remarked) nitrate of soda was better than ammonia salts by about 2¼ bushels of corn and 2¾ cwt. of straw per acre, ammonia salts gave a better return in the wet seasons by about 4¾ bushels of corn and ¾ cwt. of straw per acre.

Depending upon the absorptive power of the soil and the rate of nitrification, are the two practical questions—What is the right time to use sulphate of ammonia, with reference both to season of the year and stage of growth of crops? and—Is there any valuable residue left after the first crop has been taken from the land?

Time of Year to apply Sulphate.

With regard to the former of these points, fuller knowledge has altered the ideas originally held. When it was first discovered that most soils could firmly hold ammonia applied to them, so that it was no longer liable to be washed away, it was concluded that sulphate of ammonia might safely be applied to the land in the autumn, especially in the case of an autumn sown crop, such as wheat. The extreme rapidity with which much of the nitrogen of sulphate of ammonia may be nitrified was not at the time recognized; and it was, therefore, considered an advantage to apply it to the land some time before the period of active growth in spring. Accordingly, in the Rothamsted wheat experiments the ammonia salts were for many years applied in autumn. In the course of investigations, however, as to the composition of the drainage water from land manured in various ways, it was observed that large quantities of nitrates and nitrites, chiefly of lime, were washed away during the winter from land receiving ammonia salts (equal weights of sulphate and muriate of ammonia); and, further, that the amount of nitrates and nitrites was greatest where the largest dressings of ammonia salts were employed. Later experiments proved that the serious loss of nitrates began after the application of the ammonia salts.

The following table shows the proportion of nitrate in the drainage water from various plots of the Rothamsted wheat experiments on the different occasions when the drains ran during the year 1881-2 :—*

Table IX.—*Nitrogen as Nitrates per Million of Water.*

Date.	I. Unmanured.	II. Mineral Manures.	III. Minerals and 400 Lbs. of Ammonia Salts Sown in Spring.	IV. Minerals and 400 Lbs. of Ammonia Salts Sown in Autumn.	V. Minerals and 600 Lbs. of Ammonia Salts Sown in Spring.
Mar. 5, 6, 7 .	3·4	3·6	3·9	11·6	5·3
Aug. 30, 6.30 a.m.	1·2	1·5	..	..	..
Aug. 30, 2 to 3 p.m.	0·9	1·4	4·1	..	..
Sept. 25 . .	4·7	6·0	..	..	..
Oct. 14 . .	6·3	8·1	..	..	..
,, 23 . .	8·7	9·5	18·5	13·1	23·0
Nov. 25 . .	5·4	6·0	9·8	66·6	17·1
,, 27 . .	7·0	7·3	11·7	40·5	18·2
Dec. 7 . .	5·1	6·3	10·9	34·8	16·8
,, 17, 18, 20, & 21	4·1	5·0	7·3	26·4	11·2
January . .	3·5	3·9	7·2	22·4	10·2

In the season of the experiment the drains did not run after March 7 until after harvest, so that there was no loss by drainage during the growth of the crop. But when drainage took place later in the year, loss of nitrate occurred even from the plots receiving no nitrogenous manures (Columns I. and II.). This nitrate would be produced by the nitrification of the nitrogenous matter of the roots and other remains of previous crops. This action will probably also explain at least part, if not the whole, of the loss of nitrates where ammonia salts, spring sown, were applied in addition to minerals (Column III.), for the larger crop thus produced would, of course, leave in the soil a larger quantity of nitrogenous matter capable of undergoing nitrification.

The plot receiving minerals and 400 lbs. of ammonia salts sown in autumn (Column IV.), showed a very different rate of loss by drainage. On Oct. 23, the proportion of nitrates in the drainage water was less than where the ammonia salts were spring sown, probably because smaller crops had been produced, and there was therefore less material in the soil to undergo nitrification. On Oct. 27, the ammonia salts for the following year's crop were applied; and the next time the drains ran the proportion of nitrates had enormously increased, being then higher than in any other sample of drainage water examined. All through the winter, until the end of the experiment, the quantity of nitrates, though steadily falling, remained a good deal above that washed from any of the other plots. Judging by the results obtained on March 5, 6, and 7, we may conclude that the same exceptionally heavy loss continued until the spring. When it is remembered that about 70 per cent. of the total drainage of the year occurs during the months of October to March inclusive, it will be seen what a large quantity of nitrate may thus be lost in the course of the winter.

Column V. of Table IX. is added for comparison with Column III., to illustrate the fact that has been mentioned that the amount of nitrates lost in the drainage water was greater with increased dressings of ammonia salts.

As soon as this loss was recognized, an experiment was begun to ascertain whether the effect of the loss of nitrogen by drainage during the winter made an appreciable difference to the wheat crop. The following table shows the corn produced, in bushels, the weight of straw, and the weight of the total produce, in each case per acre, obtained by the use of

* Voelcker, "Journal of the Royal Agricultural Society of England," Vol. IX., T.S.

* Lawes and Gilbert, "Journal of the Royal Agricultural Society of England." Vol. XIX., S. S.

ammonia salts, autumn sown and spring sown, for the years 1873-9 inclusive:—*

TABLE X.

Season.	Corn.		Straw.		Total Produce.	
	Autumn Sown.	Spring Sown.	Autumn Sown.	Spring Sown.	Autumn Sown.	Spring Sown.
	Bush.	Bush.	Lbs.	Lbs.	Lbs.	Lbs.
1873	22	32⅝	2021	3079	3344	5031
1874	39⅜	29⅕	4645	2776	7094	4588
1875	25⅞	25¼	3422	3204	5110	4915
1876	23½	25½	2212	2428	3793	4083
1877	19⅞	33⅛	1835	2788	3048	4795
1878	22⅛	31¼	3071	4952	4486	7017
1879	5⅜	16¼	906	3012	1275	4063
Average . .	22½	27¾	2587	3177	4021	4927

Autumn sowing gave the best result in only one year—1874—an exceptionally dry season; while in four years the result was as decidedly in favour of spring sowing, and in two years there was no material difference.

These experiments established the fact that ammonia salts should not be applied to the wheat crop in autumn; so in 1878 and following years they were put on to the experimental wheat crop in the spring. In 1884, a further change was adopted, one quarter of the ammonia salts being applied in autumn and the remainder in spring; and this practice has been continued since. A small quantity of nitrogen is thus at the disposal of the plant for its autumn growth; but it is not till more active vegetation has commenced in spring that the full quantity is put on. The following table gives the average produce of wheat in bushels per acre per annum, obtained at Rothamsted by continuously manuring with minerals only, and with minerals and ammonia salts, for each of the three periods 1852-77 inclusive, when the ammonia salts were applied in the autumn; 1878-83 inclusive, when they were put on in the spring; and 1884-94 inclusive, when one-quarter of the ammonia salts were applied in the autumn and the rest in the spring:—

TABLE XI.

——	Minerals.	Minerals and Ammonia Salts.	Excess of Minerals and Ammonia Salts over Minerals only.
	Bushels.	Bushels.	Bushels.
1852 to 1877	15⅝	33¼	17⅝
1878 to 1883	13½	31½	18⅜
1884 to 1894	14¼	34⅜	20⅛

Too much reliance must not be placed on these figures, as the last two periods are comparatively short, and the returns may be affected by variation of the seasons. The differences, however, between the produce of the two systems of manuring—the purely mineral and the mineral and nitrogenous—probably fairly represent the comparative efficacy of the three methods of applying the ammonia salts.

We may take it, therefore, that the system of putting on a small dressing of sulphate of ammonia in the autumn, but reserving most of it until the spring, is the most economical for such a crop as wheat. The spring dressing should usually be given some time in March or early in April, so that the later spring rains may serve to distribute it through the soil.

In the case of spring-sown crops, there is no question that sulphate of ammonia should be applied in spring only, for there is no object in putting on any of it in autumn.

Stage of Growth Best for the Application of Sulphate.

With regard to the period of growth of the crop at which sulphate of ammonia may best be applied, everything points to the advisability of using it so as to supply nitrogen to the earliest stages of the plant's growth, as well as later. Apart from autumn-sown crops, therefore, we find that the application of sulphate of ammonia at the time of sowing the seed gives the best results. There is then a short time allowed for nitrification before the plant requires a supply of nitrogenous manure. In early spring, when nitrification is slow, it may even be sown and harrowed in a few days before the crop is sown. It has been suggested that better results would follow if sulphate of ammonia were ploughed in at the last ploughing for the crop; and in a very dry season, this might be advantageous, as the manure would be better mixed with the soil. In an average spring, however, in this country, there is usually enough rain to distribute the sulphate of ammonia through the soil; and it must be remembered that when it had been ploughed in, it would be subject to great loss from nitrification and subsequent drainage, if wet weather came on and delayed sowing.

It has also been suggested to mix the sulphate of ammonia with the seed before sowing. This, however, is risky, and likely to hinder the germination of the seed. Recent experiments of Vandevelde* have shown that substances dissolved in the water supplied to seeds often decrease the power and energy of germination; and this is, of course, exactly the state of things when the manure and seed are mixed together. The same experiments proved the important fact that, of the three groups of salts, nitrates are most injurious to germination, chlorides less so, and sulphates least harmful.

The steeping of the seed before sowing in a solution of sulphate of ammonia has been suggested; and as long ago as 1843, a communication was made to the Royal Agricultural Society† detailing most favourable results from this method. It is unsafe in practice, however; for the vitality of the seed is easily injured in this way.

Dressings of sulphate of ammonia, or of any nitrogenous manure in which the nitrogen is readily available for the plant's use, is uncertain in its action if given too late in the life of the crop. It has been stated already that one effect of the application of nitrogenous manures is to retard the ripening of the plant. If this takes place late in the crop's life, its growth may go on; so that in the case of a corn crop it ripens badly, and in late districts the harvest is put off till the comparatively unfavourable weather of the late autumn, or, in the case of roots, the crop has to be taken up or fed in an immature condition, when, of course, its feeding value is less than it should be.

Another effect of the use of nitrogenous manures will be remembered—viz., the increased formation of leaf. In the case of a late dressing, this result is exaggerated, much of the energy of the plant being consumed in this way, and the amount and quality of the seed being deteriorated. Following as a secondary result from this rankness of growth, is the great tendency of corn crops to go down or be laid, when they have been dressed with nitrogenous manures late in the season of growth. Such crops are also more likely to be injured by rust and mildew, or blight.

It is worth while to point out here that the unfavourable effects mentioned are not the result of the late application of sulphate of ammonia only, but are common to all kinds of concentrated, readily available, nitrogenous manures. In fact, sulphate of ammonia is on the whole less likely to do harm to the crop, even when used injudiciously, than nitrate of soda.

Use of Sulphate on Different Soils.

The time and manner of application which enables sulphate of ammonia to give its best results will, however, depend a good deal on the soil treated. On light sandy soils, which have little power of holding manure of any kind, and in which nitrification takes place rapidly, sulphate should be applied just when the plant needs the nitrogen—that is, when growth is just beginning. Two, or even three, small dressings will also give better results than the same quantity of the manure put on at one time. By carrying out these principles, the crop will have the opportunity of using a larger proportion of the nitrogen, and less will be washed away.

On heavy land, the exact reverse is the case; for such soil has great power of holding ammonia, is not well adapted for nitrification, and is so impervious to water that nitrates, even when formed, are washed away comparatively slowly. There is, therefore, less risk of loss, and the sulphate of ammonia may be applied rather before the crop needs it, and all at one time.

Soils containing a large proportion of lime are in their texture and physical properties generally similar to light sandy land. There is, however, the difference already mentioned—that there is more risk of loss of nitrogen to the air

* Lawes and Gilbert, "Journal of the Royal Agricultural Society of England," Vol. XVI., S.S.

* Bot. Centr., 69.

† Campbell, "Journal of the Royal Agricultural Society of England," Vol. IV.

in the form of carbonate of ammonia from calcareous soils than from others. It has been shown that this loss, in the case of most soils, is extremely small, and, it may be added, even from calcareous soils need generally be considered only when the usual plan of top-dressing is adopted. Less loss will generally occur when the sulphate of ammonia is ploughed or harrowed in—at least if care be taken to apply it a short time only before the seed is sown. Altogether, these exceptionally calcareous soils are not so well adapted for the use of quick-acting ammoniacal manures as either light or heavy land.

On the other hand, soils deficient in lime, whether they are of vegetable or mineral origin, are also unsuited for the use of sulphate of ammonia. This will be understood from what has been said as to the important part lime plays with regard to the absorptive power of soils and the process of nitrification, and need not be gone into more fully. It may be added, however, that soils which are poor in lime often contain large quantities of nitrogen in an organic form. When this is the case, there is obviously greater economy in bringing this nitrogen into action by liming, &c., than in applying nitrogenous manures.

What has been said with regard to the action of sulphate of ammonia on different soils, must be taken as applying directly to soils of extreme composition—exceptionally sandy, clayey, or calcareous. All the soils between these extremes—that is, the great majority—may be dressed with sulphate with good results. The above remarks, however, indicate the general principles which must govern the mode of application, according as the character of the soil approaches most nearly to one or other of the extremes mentioned.

Residue from Sulphate of Ammonia.

On the question whether any valuable residue is left after the first crop has been removed, some difference is found in the evidence afforded by different experiments. In both the Rothamsted and the Woburn wheat experiments, special attention has been paid to the point. At the former experimental station, plots have been manured with mineral manures alone and with ammonia salts alone in alternate years. Thus, when the mineral manures are applied, there is abundance of mineral matter, and any residue that may be left from the previous year's dressing of ammonia salts; while when ammonia salts are used, there is a full supply of nitrogen and the residues left from the last mineral manuring. On the heavy land at Rothamsted, the mineral manures with residues of ammonia salts gave, on the average of forty years, 15¼ bushels of wheat per acre, against 15 bushels on land which had received mineral manures only each year of the same period. This seems to show that, on the soil experimented with, there is practically no valuable residue.

It should be noticed, however, that for the first twenty-four years of the experiment, the crop grown with minerals and residues of ammonia was rather better in proportion to that obtained by the use of minerals alone, though, it will be remembered, the ammonia salts were at the time applied in the autumn, and therefore were not giving their full effect.

At Woburn, on comparatively light land, an experiment carried out on similar lines, except that mineral manures were applied every year, gave rather different results. On the average of fifteen years, the following results were obtained with sulphate of ammonia and nitrate of soda respectively:—

Table XII.

Manures.	Ammonia Salts.	Nitrate of Soda.
	Bushels.	Bushels.
Minerals and nitrogenous manures.	37·2	34·0
Minerals and residue of previous year's nitrogenous manures . .	23·1	16·4

The average produce of the land continuously manured with minerals only was 14·4 bushels for the same period. The results, therefore, show that the residue left after the removal of the first crop is capable of producing an increase of about 8¾ bushels per acre when ammonia salts are used, and of 2 bushels with nitrate of soda.

The difference between the Rothamsted and the Woburn results is difficult to account for; but it may perhaps be explained by the difference of soil, and by the fact that at Woburn minerals were applied every year, but at Rothamsted only in alternate years. The shorter duration of the Woburn experiments may also influence the result; for at Rothamsted, as we have noticed, at first the residues of ammonia salts had some effect.

It may be safely concluded, however, that a considerable residue from ammonia salts may remain in the soil after the removal of the first crop. It is probable that much of this is in the form of nitrogenous organic matter, such as roots and stubble left by the crop, which gradually decays and undergoes nitrification. A part, however, seems in the Woburn experiments to have been left untouched by the first crop, and to have remained in its original state in the soil; for the residue left by the ammonia salts gives its greatest effect in the year following an under-average crop obtained with a direct dressing of nitrogenous manure. For instance, the following results were obtained in the wheat experiments at Woburn in 1895 and 1896, the former of which years was exceptionally dry, and therefore prevented the full action of the ammonia salts. It will be remembered that mineral manures were applied every year to each plot.

Table XIII.

Plot.	Nitrogenous Manure.	1895.	1896.
8A	Ammonia salts .	Applied, 17·2 bush.	Omitted, 26·9 bush.
8B	,, ,, .	Omitted, 17·0 ,,	Applied, 30·5 ,,
9A	Nitrate of soda .	Applied, 20·1 ,,	Omitted, 12·0 ,,
9B	,, ,, .	Omitted, 13·4 ,,	Applied, 25·9 ,,

In 1895, it will be seen that the application of ammonia salts on plot 8A gave practically no larger return than the mere residue from the previous year's manuring on plot 8B. But the ammonia salts which failed to act in that year gave an extra return in 1896; the yield on plot 8A in the second year being within about 3½ bushels of plot 8B, to which in 1896 ammonia salts were directly applied. We see from this that, if ammonia salts are not used by the crop to which they are applied, a considerable proportion may remain in the soil for the use of succeeding crops. Moreover, this residue must be to a great extent in its original state; for if it consisted only of roots and other plant refuse, we should find that when the nitrogenous manure produced a small crop (which would, of course, leave comparatively little organic matter in the soil), the residue would also produce little effect. But the exact opposite of this occurred in the above experiment. A dry season on the light soil at Woburn may interfere with nitrification during the hottest part of the year, when normally it takes place most rapidly. If this happens, the washing away of nitrogen in the form of nitrate during the autumn will be comparatively small.

The comparison given in Table XIII. between ammonia salts and nitrate of soda is important, because it illustrates one marked difference in the action of these two principal nitrogenous manures. The figures relating to nitrate of soda show clearly that if this manure is not used by the crop to which it is applied, it will be practically lost; for on plot 9A, though in the dry year of 1895 the crop was a good deal under the average obtained by the direct application of nitrate, in 1896 the residue gave a crop below the average of those obtained from such residues. (See Table XII.) On the other hand, the residue of the ammonia salt, under the same conditions, produced a crop 3·8 bushels above the average.

Effect of Applying too much Sulphate.

Passing on from this question, a word must be said with regard to the effect of different quantities of sulphate of ammonia on crops. All the injurious effects arising from the use of nitrogenous manures too late in the season—such as the late ripening of the crop, the over-production of leaf and poor yield of grain, &c.—may also be produced by their application in too large quantity. In both cases, it must be observed, the injury is done, not by any unsuitability of the manure for use on the farm (a conclusion too often arrived at from very insufficient evidence), but by its use in an injudicious manner.

The quantities of sulphate of ammonia usually suitable for the chief farm crops will be mentioned later, when the crops are considered in detail. For the present, however, it must be noticed that no absolute rule can be laid down

as to the quantity of any manure that will give the best results. Soils and seasons differ enormously; and the effect of manures varies in proportion. Even in the case of similar soils and seasons, differences in condition of the former may cause different results from any dressing of manure. The benefit arising from the use of nitrogenous manures on barley after wheat, and the injury they do to barley after roots fed off by sheep, is a good example of this.

The effect of the application of a given quantity of sulphate of ammonia or other nitrogenous manure, depends also on whether the crop has a plentiful supply of the mineral substances it requires. If not, a comparatively small dressing of the nitrogenous manure is likely to produce all the possible injurious effects to an exaggerated degree. If, on the other hand, all the essential mineral substances are in abundance, a comparatively large dressing of nitrogenous manure will only stimulate a strong but healthy growth and will therefore prove remunerative. A balance or proportion between the mineral and nitrogenous manures is therefore important. Failure to realize this is one of the common causes of unsatisfactory results from the the use of nitrogenous manures, and is chiefly responsible for exhaustion of the soil which sometimes follows their use.

Effect of Sulphate of Ammonia on the Soil.

The effect of sulphate of ammonia on the soil must also be mentioned. In explaining the action of the soil in absorbing ammonia, it has been stated that when sulphate of ammonia comes into contact with carbonate of lime in the soil, carbonate of ammonia and sulphate of lime are produced, of which the last named is washed away in large quantities in the drainage water. Loss of lime, therefore, follows the use of sulphate of ammonia. Under any conditions likely to arise in ordinary farm practice, this will not be of much consequence, except on soils specially deficient in lime. Even then an occasional liming will supply all the lime required, and will in any case be useful or even necessary to the soil, quite apart from the effects of sulphate of ammonia. In long-continued experiments in continuous cropping and manuring, however, such as those at Rothamsted and Woburn, where very large dressings of ammonia salts are in some cases given every year, the soil after a time shows clearly the effects of this removal of lime. It becomes very sour, and the crops grown become unhealthy. For instance, in the Woburn permanent barley experiments, the average produce per acre from the use of ammonia salts, which, in the first three periods of five years each, had been 36·6 bushels, 42·2 bushels, and 34·5 bushels per annum respectively, fell to 21 bushels per annum for the fourth period—the sixteenth to the twentieth years of the experiment—a proportionately greater falling off than occurred on the plots where ammonia salts were not employed.

When a soil has thus been robbed of its lime, it becomes like one naturally deficient in that constituent—its absorptive power for ammonia is injured, and nitrification may be stopped for want of a base to combine with the nitric acid as it is formed. We must repeat, however, that these extreme effects are not likely to result under the usual management of a farm, in which sulphate of ammonia is only used occasionally, and in comparatively small quantities.

Sulphate of ammonia is not alone among the artificial manures in causing injury to the land when used continuously in excessively large quantities. On heavy land, nitrate of soda injures the texture of the soil, by increasing its power of retaining moisture. On clay land this change, even under farming conditions, soon becomes appreciable, so that among farmers nitrate of soda is reputed to make clay plough up "like liver," sodden and wet, and work with difficulty. For example, in the experiments on continuous oat growing at Rothamsted, the plots dressed with nitrate of soda had become so retentive of moisture by the sixth year that it was found impossible to work the land properly, and very irregular crops were produced in consequence.

Method of Applying Sulphate.

The practical difficulty of applying a small quantity of sulphate of ammonia (sometimes less than a hundredweight per acre), so as to spread it evenly over the surface, and the unevenness of crop that results unless this is done, naturally suggests the advisability of mixing the manure before sowing with two or three times its own bulk of something that will serve to dilute it, so to speak—that will add to its bulk without adding to the nitrogen it contains. It is then easier to distribute the sulphate of ammonia evenly; and any trifling irregularity in the sowing no longer causes harmful differences in the crop.

Sand, ashes, and salt are all commonly used, and all serve their purpose, provided they are in dry condition, and are mixed with the sulphate of ammonia just before use. Salt, however, is often damp, or even if dry when mixed with the sulphate, it will become damp rapidly by taking up moisture from the air. Hence the importance of mixing just before use; for it need hardly be said that, if the mixture be damp, the difficulties of even sowing are greatly increased.

Thorough mixing of the manure and ashes, or whatever may be used, is important, though sometimes neglected; for it is obvious that, without care in this respect, there can be no gain in evenness of sowing.

Where other manures are to be applied at the same time, they are frequently mixed with the sulphate of ammonia, instead of any such comparatively inert substances as those mentioned above. This plan answers the required purpose quite well, provided that such substances as kainite, &c., which take up water from the air, and might therefore spoil the condition of the mixture for sowing, are only mixed in at the last moment before use, and are themselves in a dry state. The suitability of sulphate of ammonia for mixing with other substances is taken advantage of by manufacturers of compound manures, who employ it very largely as a source of nitrogen for corn, grass, and other manures. It compares favourably in this respect with nitrate of soda, which becomes damp when mixed with other manures, and spoils the condition of the mixture.

An important exception must be made in the case of manures containing lime or carbonate of lime. Any such manure—as, for instance, Thomas phosphate or basic slag—if mixed with sulphate of ammonia will cause a considerable amount of ammonia to be given off into the air, especially during the mixing and sowing. Carbonate of lime is less active in this respect, but may cause an appreciable loss—particularly if the mixture is damp. It may be added that nitrate of soda suffers no loss of nitrogen in this way by contact with lime.

Composition of Sulphate of Ammonia.

In the pure state sulphate of ammonia has the chemical formula $2NH_4,SO_4$, implying that two atoms of nitrogen, eight of hydrogen, one of sulphur, and four of oxygen are united in it. Expressed by weight, its composition is :—

Nitrogen	21·21 per cent.
Hydrogen	6·06 „ „
Sulphur	24·24 „ „
Oxygen	48·48 „ „

As it is usually sold, sulphate of ammonia of good quality is of from 95 to 97 per cent. purity—that is, 95 to 97 per cent. is actual sulphate of ammonia; the remainder consisting chiefly of moisture, with any earthy or other impurity that may have become accidentally mixed with it. Such manure will contain from 20·15 to 20·57 per cent. of nitrogen.

For trade purposes, nitrogenous manures are usually described as containing a certain percentage of ammonia, though in many cases their nitrogen is not in that form. This is merely a conventional way of expressing the amount of nitrogen present. It has been said that there are fourteen parts of nitrogen by weight in ammonia and three of hydrogen. Therefore fourteen-seventeenths of the weight of ammonia consists of nitrogen. Similarly, if a manure contains 14 per cent. of nitrogen, it will be described as having 17 per cent. of ammonia.

In the case of sulphate of ammonia, therefore, containing 20·5 per cent. of nitrogen, the amount of ammonia equivalent to this will be $20{\cdot}5 \times \frac{17}{14}$, or almost exactly 24·9 per cent. In deciding upon the relative economy of using one nitrogenous manure or another, and in comparing market quotations, it is important to bear in mind the distinction between nitrogen and ammonia, and the numerical relationship (14 : 17) which exists between them.

Cost and Valuation of Sulphate.

It cannot be too clearly understood that it is only the nitrogen that is of value in sulphate of ammonia. Hydrogen, oxygen, and sulphur are all necessary for plant growth, it is

true; but they are supplied so freely by natural means that there is never any need to apply them as manure. We may therefore fairly consider that the whole price paid for sulphate of ammonia is given for the nitrogen; and we can thus easily find out what the nitrogen costs per pound. For instance, a recent quotation for sulphate of ammonia is £10 2s. 6d. per ton, containing 24 per cent. of ammonia. A ton will contain $2240 \times \frac{24}{100} = 537{\cdot}6$ lbs. of ammonia, equal to 442·7 lbs. of nitrogen. The price of ammonia in the manure is, therefore, £10 2s. 6d. ÷ 537·6 = 4¾d. per lb.; and of nitrogen, £10 2s. 6d. ÷ 442·7 = 5¾d. per lb.

Calculations of this kind may be used for comparing one manure with another. For instance, nitrate of soda contains about 15·65 per cent. of nitrogen, equal to 19 per cent. of ammonia; that is 350·5 lbs. of nitrogen per ton, equal to 425·6 lbs. of ammonia. The price at the time of writing is about £7 15s. per ton, at which price nitrogen costs £7 15s. ÷ 350·5 = 5¼d. per lb.; and ammonia, £7 15s. ÷ 425·6 = 4⅓d. per lb.

A more usual way of comparing the cost of nitrogen in different manures, and a more convenient one, is by calculating the cost of nitrogen or ammonia per unit—that is, the price per ton of the manure for each 1 per cent. of ammonia or nitrogen. For instance, in the example taken above the sulphate of ammonia is said to contain 24 units of ammonia or 19¾ units of nitrogen. The price per unit of ammonia is therefore £10 2s. 6d. ÷ 24 = 8s. 5¼d.; while a unit of nitrogen costs £10 2s. 6d. ÷ 19¾ = 10s. 3d. Similarly, the nitrate of soda is said to contain 15·65 units of nitrogen, or 19 units of ammonia; the price of the former being nearly 9s. 11d. per unit, that of the latter 8s. 2d. per unit. In actual working, this system of estimating the cost per unit is very simple and helpful in comparing the relative costs of manures; for by taking into account the suitability of two manures for any given purpose, we can decide on their comparative economy. It will easily be realized that nitrogen is sometimes cheaper in one manure, sometimes in another, according to variations in the market quotations. Very often one comes across a tendency to buy a manure because it is at a low price per ton; but this may not be the cheapest manure. The cost per unit of nitrogen, or whatever of value the manure contains, may be higher than that in another manure at a larger price per ton.

At the prices mentioned above, it will be seen that nitrogen in sulphate of ammonia is slightly more expensive than in nitrate of soda. The reverse of this is often the case, owing to variations in prices; and, indeed, for some years sulphate of ammonia has been generally the cheapest source of nitrogen in the market—the price per unit of nitrogen having been as a rule lower (sometimes as much as 20 per cent. lower) than in any other manure supplying nitrogen in a condition equally ready for the use of crops.

Impurities and Adulterants.

Good samples of sulphate of ammonia generally contain little impurity except moisture, with a very small amount of sandy matter, some free acid, and often still less common salt. In impure specimens, however, the proportion of both earthy impurity and of common salt is sometimes considerable. The well-known test of putting a little of the sulphate of ammonia on a red-hot shovel, shows their presence; for the sulphate of ammonia disappears as a vapour, leaving the impurities behind. A good sample will, therefore, leave practically no residue when tested in this way. Sulphate of soda, and sometimes sulphate of iron also, are occasionally found, being used as adulterants; but their presence is, of course, detected by the same test.

Now and then cases are reported in which sulphate of ammonia is put on the market containing considerable quantities of free sulphuric acid (oil of vitriol). It need hardly be said that such manures are harmful to crops, and should be avoided.

An even worse impurity—though a comparatively rare one—is the thiocyanate or sulphocyanate of ammonia, which is one of the products from the distillation of coal in the manufacture of gas. It is so powerful a poison to plants that even a few pounds per acre of it in a dressing of sulphate of ammonia will do great damage to the crop. The thiocyanate is easily detected by adding a solution of ferric chloride to a solution of the manure, when, if it be present, a deep red colour will appear.

At one time, arsenic was not uncommonly found in sulphate of ammonia—derived from the impure acid used in its manufacture; but it is now rarely present.

Effect of Sulphate on Individual Crops.

Having dealt with the general facts and principles connected with the use of sulphate of ammonia, we will next consider its action upon the chief farm crops, as shown by the results of experiments. As nitrate of soda is the only other manure practically comparable with sulphate of ammonia, we will, where possible, compare the action of the two substances.

(To be continued.)

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 250.)

The Stock Exchange was much depressed at the opening week. There was a degree of apprehension as to the course that money might take, which seemed to throw people out of their reckoning. Extreme caution was the rule until t should be seen what the Bank Directors would do on Thursday. When that important day came and went without a rise in the rate, a better feeling was rapidly restored; and this was aided by improved prospects in the Transvaal. So prices advanced; and by the close a fair proportion of the losses of the preceding week had been recovered. But there was no activity at any time; the weather was too hot for that. The Money Market closed a good deal easier than it opened, with a supply quite equal to the demand, and with lighter discount rates. Business in the Gas Market would have been quiet enough but for dealings in Gaslight and Coke issues, which had an interesting week. The announcement of the Directors that they could pay their statutory dividend and carry forward nearly £140,000 came as a surprise to most. It had transpired, in the course of the proceedings in the Select Committee, that the Company had had a moderate increase in the sale of gas; but few had followed the advanced prices which all residuals have been realizing for the half year. The consequence was that the ordinary stock, which opened at 104¼, and was hanging fire at those figures or a little better, had a smart rise when the announcement was made known. This culminated in 112½ being touched on Saturday; but the concluding mark was nearly two points lower. The secured issues also benfited; the maximum being advanced a point. South Metropolitan was quiet, but improving; and on Friday it changed hands at 140—a figure not attained for some time past. Commercials were neglected and unchanged. The Suburban and Provincial group were also quite devoid of incident, except that, for some reason or other, the buying price of Brighton was put down. The Continental Companies were extremely inanimate, and made no move. Among the remoter undertakings, changes were limited to a rise in River Plate. The Water Companies were quiet as usual. Prices generally were steady, except for East London, which had a further fall.

The daily operations were: Limited business at moderate prices was the rule on Monday. In Gas, Brighton original fell 2½; and in Water, East London 2½. Signs of more animation were apparent on Tuesday; but quotations stood still. East London Water fell 1. On Wednesday, movement in Gaslights began; and the ordinary rose 1. Business was almost all in Gaslights on Thursday; the ordinary advancing 2, and the maximum 1. Friday was quieter; but Gaslight ordinary rose 1½, and River Plate ¼. Saturday was unusually animated; and Gaslight ordinary gained 1 more.

ELECTRIC LIGHTING MEMORANDA.

The Electric Lighting of the City of London: The Company's Offer to the Corporation—Illusions Dispelled—The Pity of Competition—Failure of Statutory Regulation.

There is still a good deal of letter writing and talking over the City of London electric lighting. The shares of the City Company have fallen slowly but steadily. Some surprise has been expressed at the fact of the Charing Cross Company's shares not having risen appreciably on the passing by the House of Commons of the Bill confirming their competing Order; but the explanation is easy to find. Charing Cross shares are quite high enough for this class of investment; and the new City branch will never be a very profitable undertaking, even when it is fully developed, which will be the work of years. The new competitive supply will benefit the consumers more than anybody else. It will provide employment for an additional million of capital, in the comparatively thrifty hands of the Charing Cross administration. A good deal of work will be given out for the new establishment; and the old Company will have to make the best of the altered position. The last move on the part of the City Company was not particularly well advised. They wrote again to the Corporation offering to do various things—among others

to supply current on the Charing Cross Company's terms, if the latter Company are not admitted into the City; or, as an alternative, to sell their undertaking to the Corporation for such an amount of stock as will produce an annual income of £75,000. This estimate of the maintainable profit of the undertaking is open to the criticism that it takes no account of the imminent competition. It is based upon an average charge of 6·22d. per unit, which is at least 25 per cent. too high. To buy on these terms would be at best like getting change for a shilling, so far as the Corporation interest goes; while they would have all the trouble and risk of the business. At all events, the Corporation do not see any reason why they should pension off the shareholders in this way; and at a special meeting held last week for the purpose of considering the matter, the subject was simply passed over.

The Confirmation Bill was before the Lords Committee yesterday; the Corporation opposing as before. It will be well for all parties interested in the matter to face the situation as it exists, without cherishing any illusions. A contemporary which has always been at enmity with the City Company now hypocritically declares its "fear" that "there is nothing for it but that the City Company, which has reaped a rich harvest from its monopoly, should now begin to face competition, which will be to the benefit of the consumers and of the City Corporation." This is all right, with the exception that the "rich harvest" has not actually been reaped. The City Company's dividend has never been a high one, as London Electricity Supply Companies' dividends go; and now it will be less, or appearances are deceptive. A correspondent of a financial newspaper, writing on the same subject, furiously attacks the Corporation for breaking the contract with the City Company, which, he affects to believe, conferred "the exclusive right of lighting for a period of twenty-one years." This gentleman holds out the pleasing prospect that after the Charing Cross Company have laid out a million on mains and plant for supplying the City, the House of Lords may uphold the impeached contract, and so ruin the interlopers. The wish is probably the father of this thought; but it is a fond delusion all the same. Contract or no contract, the power of Parliament to sanction competing supplies of electricity for lighting and other purposes is incontestable.

Honestly, without either sympathizing with or blaming the City Company, we regret that matters in regard to the electric lighting of the City of London should have taken the turn they have. That Parliament, at the instigation of the Board of Trade, should have fallen back upon the world-old expedient of competition as a means of procuring the cheapest electricity supply for the citizens of London, is, from our point of view, a lamentable confession of failure to secure the same result by the operation of the Electric Lighting Acts. The citizens have undoubtedly an indefeasible right to the cheapest and best supplies and services that human skill and enterprise can furnish. Every community has the same right; and the means whereby the object is meant to be attained, must be judged by their efficiency for the purpose. Competition, ruthless, incessant, unforgiving, is the means employed by Nature to keep her creatures up to the mark; and man has not improved upon the principle in his commercial matters. Even in those common affairs of civilized life in which a different principle seems to be recognized—as in the postal service, for example—efficiency is preserved by the pressure of public opinion; and the rivalry of different administrations amounts to competition. In such a business as electricity or gas supply, however, the waste and hardship of competition are so obvious that intelligent public opinion, in the older communities at any rate, has tried every conceivable device for dispensing with it. This is the reason why we have Gas and Electric Lighting Acts, concessions, and the like arrangements for regulating a monopolistic service in the public interest.

As was shown in the "JOURNAL" some time ago, a true economic idea runs through English legislation on this order of subjects. Our Electricity Orders, with their requirement for the publication of accounts on the older gas model, assumed that efficiency of administration and management would exist. If this assumption were justified, obviously one board of control, one management, one staff would be cheaper than two for doing a stated amount of work. In the leading case of the City of London Electric Lighting Company, the assumption has been falsified. There is no blinking the enormous significance of this experience. This monopolistic service was more costly to the community than similar services furnished next door, so to speak. Consequently, the legislation, or arrangement, or concession, or whatever it might have been that operated in this sense, had failed of its proper object, and stood condemned. The City Company own as much by offering to come down to the price forced upon them by competition. But what was the motive power of this belated offer? Competition, and nothing else. So the hard old rule is justified once more; and Parliament practically gives up the endeavour to dispense with it and substitute a less wasteful statutory code of regulations in its stead. Municipalization, as we have already argued, is no adequate substitute for the force of competition, because it can, and does, make its own standard of efficiency—a privilege which Nature never accords to her creatures. It is the cat who is responsible for keeping the mouse up to the mark.

LIGHTS ON ENGINEERING EDUCATION.

Two suggestive addresses to young engineers were recently delivered to the "graduating classes" of American Universities granting degrees in engineering, by Captain Henry C. Taylor and Mr. Edwin Duryea respectively. Both orations contained matter too good to be left for local application, or even in the columns of the "Engineering Record," which report them at length; and we accordingly propose to appropriate some of it, adding thereto such comment as may appear apposite.

Captain Taylor chose for his leading motive that aspect of a civil engineer's calling which is perhaps the least understood—the duty and responsibility for directing and encouraging the work of subordinates. A successful engineer means a man who can lead and direct, as well as do good work himself. When people talk of the work of an engineer—as when, for example, they speak of the new Birmingham water supply as being the work of Mr. Mansergh—the idea suggested is that the individual does it all. So he does, in a very true sense, inasmuch as he is personally responsible for the design and its execution. But in an equally true sense the engineer is also the head of a whole corps of assistants, every one of whom he must know how to select and then to employ to advantage. The analogy irresistibly presented is that of a general in the field, or a captain on his quarter-deck. However personally able an engineer may be, unless he is also a capable leader of men, he cannot go far nor effect much. Indeed, there are many posts filled by engineers in which the work of the chief is more organization and direction than anything else.

Wherefore, whosoever is desirous of becoming an engineer must have a soul above drawing boards and formulæ; or he can never rise higher than a draughtsman. If he is a good man of business, he may become a capital resident engineer or contractor's agent. If over and above natural aptitude, acquired skill and knowledge, and native common sense, he is endowed with the faculty of managing men—whether above or beneath, himself included—the engineer is equipped at all points for his boundless career. Is this faculty of leadership possible of cultivation? When one only looks at the finished exemplar, the negative answer is suggested. But the experience of army and navy chiefs is to the contrary. They know that those who will be leaders of men if they live and are fortunate, must be trained accordingly. Captain Taylor, himself a navy man, declares that the necessity of educating the mind with the object of fitting young men for their life work, is not a matter of opinion. Experience is the great teacher, truly; but we must realize that the experience of one man or one lifetime is not enough. We must be governed by the experience of many men and many nations, which is the true learning. It is to be borne in mind, nevertheless, that a good principle must not be pushed too far. Learning must be limited. The mistake so many people make is to argue that if a teaspoonful of medicine is good, a tablespoonful should be better, and a bottleful best of all. This, of course, is absurd; but it is an absurdity often encountered in instructional agencies. The wise man surveys the whole range of education, and recognizes that for himself the concrete gains of learning are but a small portion of the good of the operation, and that the greater gain is the strengthened and polished mental power which results from the endeavour to learn.

This being the truth, the kind and amount of material information obtained in the process of opening and exercising the mind, becomes a mere detail. Unfortunately, our educational system of late years, since the utilitarian ideal overtook the scholastic habit, has rather tended to sink the requirements of the mind under the piles of subjects of information "taught"—not learnt. Here again, there is something in the utilitarian principle; but it must be kept within bounds. We must, at some period of his life, differentiate in the teaching of the young man according to the bent of his powers, tastes, or the force of his circumstances. The modern tendency is to differentiate earlier than formerly. The prime necessity is that the process should not begin too early; certainly not during the elementary school age. It is beginning to be perceived that the cramming of school children with so-called "useful knowledge" before the proper age for thought, is a mistake. Such "subjects" are not useful, and they are not knowledge. When the college age comes to those whose circumstances and intellects give them this further period for study, specific instruction may be shadowed forth—again, not without regard to balance. Life not being long enough to train an ideal intellect to perfection, as Captain Taylor remarks, we must accept the slight warping of mind caused by the concentration of powers upon special departments of human knowledge.

Captain Taylor brought out the point that is rarely kept in sufficient prominence in discussions upon the education and training of engineers—that the followers of this profession, like soldiers and sailors, need imperatively to mix with men early in life. If an engineer is to make a good chief, head of a department, or master of men, he must begin very early to learn what actual working men are like. This consideration bears directly upon the important question as to whether training at the bench—that is to say, in the works generally—should precede or follow the period spent at college. The once favourite idea that

the two kinds of training might proceed simultaneously—work all day, study at night—has yielded to the more humane, as well as the older, opinion that "all work and no play makes Jack a dull boy." A little light evening occupation for the mind once or twice in the week, or oftener in the winter, is all very well; but the theoretical equipment of a civil engineer cannot be gained in this way.

Captain Taylor says that he is strongly of opinion—and most men of the world will agree with him—that "ability to work successfully with men and in charge of men is one which is easily gained while young, and can rarely be acquired in later life." He holds that theory, and office work, can be taken up later; "while the rougher work of ordering men, of consulting foremen, of planning for to-morrow's work, the gathering of material so that there shall be no delays, are duties that are easier and better learned in the earlier days. . . . . It is in these duties that the mind grows clearer, the perception is quickened, the power of observation enlarged; while the intimate personal knowledge of the delay and embarrassment due to weather, to lazy workmen, to careless foremen, prove of the utmost value later on." Weighty words indeed, coming fresh from the lips of a master of men! We can recall a visit paid once upon a time to a young gas-works superintendent who has since risen high in his profession. The subject of the interview was to have been a curious point of pyrology arising out of the application of gaseous firing to gas-retorts, upon which the works manager in question was an enthusiast. The season was the depth of winter; and there had been a three weeks' frost. The station was on the riverside; and when the manager was hunted down he replied with a laugh to the conventional query "How are you getting on?" with the statement "For weeks I have been chiefly occupied with getting lime barges into the dock!" This was engineering; but not as taught in colleges. The story must not be misunderstood as a reflection upon the value of collegiate teaching. The works manager in the case referred to could frame a formula, on occasion, as well as another; but the charms of the calculus will not compensate for a "bad test" of gas made under difficulties.

Mr. Duryea's address was to the Association of Civil Engineers of Cornell. His first remarks warned his auditory against the expectation of much "outside reward" for engineering merit; and his next advice was to seek the hardest of work, and plenty of it. He observed that civil engineering is not an exact science; natural laws being so little known, and so confused by commingling, that the most precise calculations of the strength of structures are merely a basis upon which to apply the judgment. All the larger engineering questions are mainly matters for judgment exercised within very broad limits. The speaker's thesis was that data, calculations, all that can be learnt in the way of engineering, are useful only as defining the limits within which the judgment must do its work. "The use of limits is valuable and far-reaching. It may even be said that the whole practice of civil engineering is based on it. It will solve many problems in a negative way, as it is frequently sufficient to ascertain whether a structure is strong or efficient enough for a particular use, rather than to ascertain its exact strength or efficiency. Cost estimates can always be made by its use, the limits being wide or narrow to correspond with the experience and judgment possessed . . . results can generally be secured by approximate methods." The judgment of the engineer comes in to distinguish essentials from non-essentials.

"In any piece of engineering work, it is necessary to distinguish sharply between the end sought and the means; and between the primary end and the less important results." There are usually several different ways of attaining the desired end; the selection being often governed by secondary considerations. "The weak point should always be sought." There is always a weak, defective, or uncertain point in every scheme; and it is to this that the engineer's first attention should be directed. "He should make strong efforts to improve it or bring it above the next weakest, which should then receive his attention." While the weakest spot remains undealt with, all the labour on the rest of the scheme may be in vain. Again, in studying any piece of work, the young engineer is told not to be satisfied with knowing the results achieved. He is advised to endeavour to ascertain whether the work could not have been done better, more cheaply, or more quickly—whether anything could have been left out without impairing the general result. "In making designs and estimates for strength, time, or cost, average conditions or the worst should be assumed. Most under-estimates can be elaborately explained away afterward. But the fact remains that the extra time or money is gone, or that the structure has failed to perform its duty; and a man who could have foreseen such excesses would have been a better engineer. It is the unforeseen that always happens; but the better the engineer, the less is unforeseen." Again, "the ease and certainty with which an engineering problem can be solved depends as much as anything upon the form of its statement. Those which seem unsolvable often become clear and easy when recast in other forms. The form likely to be the clearest is the rational one, following out the train of operations step by step in the order in which they would naturally occur or be developed."

All these are words of wisdom. Many other helpful things were contained in the address; but those we have repeated will suffice to show the author's quality.

GAS OR STEAM HEATING.

In several articles recently published, we have offered some observations on the part that coal gas might play in connection with those improved plans of housing the middle class of our town populations which the increasing pressure of the "servant difficulty" may bring into favour. For truly, while the popular newspapers dilate upon the burning question of the housing of the poor, the troubles of those who can afford to pay a moderately high rent for their dwellings, yet cannot get really comfortable quarters at any price, are equally pressing. In London, in particular—although the same remark applies to other populous places—the only practical check upon the enterprise of the speculative builder in the suburbs is the fashion of "flat" building near the central region. Yet while the ordinary town "flat" continues to be planned in such a way as to accentuate as far as possible the dependence of the occupant upon domestic servants, to the same degree will the possibilities of the "flat" system remain unrealized. The truth of the situation probably is that the much talked-of "servant difficulty" is not quite acute enough yet for householders to fully appreciate the labour-saving advantages of gas for heating and cooking. It may be some time before the average householder will insist upon gas-kitcheners and gas-fires as being necessary fittings of every town residence; but it is evident that when public opinion has reached this stage, the structural requirements of dwellings, "flat" or otherwise, will be modified. With the disappearance of the coal cellar and dust-bin, much of the trouble of housekeeping will also vanish.

Very slowly, as becomes the character of the race, organized public services are encroaching upon the once undivided realm of the domestic servant. The operation of the window-cleaning companies is an illustration of the tendency under notice; but the movement is at yet only in its infancy. It is perfectly ridiculous how much of the comfort and even the health of the most highly civilised communities depends upon the lowest and least efficient order of labour—labour, moreover, which is becoming scarcer every day, while the substitutes for it still delay their coming. People grumble about the scarcity of good domestic servants, without, in the majority of cases, making a serious effort to reduce the measure of their dependence upon them. The time is coming, however, when everybody will have to face this necessity. It should be helpful, therefore, to observe how the emergency has been met by those to whom it has long been familiar.

There is the example of America. Here climatic conditions have combined with economic and industrial exigences to force upon the people some solution of the problem of house warming without the onerous labour of ordinary firing. As the American people crowded into the towns, the traditional "wood pile" that figures largely in the national literature had to be abandoned for the hot-air furnace in the basement. There was no literature about the latter. It did not lend itself to poetry; but it was handy. Recently, however, improved methods of systematic house warming have gained favour on the other side of the Atlantic. Manufactured gas being dear, and the fuel requirements of an American householder considerable, with an outside temperature frequently going down to zero, it is only in the "natural gas" regions that gas firing has been much used for domestic purposes. Here, however, it is vastly appreciated. Professor Edward Horton, the State Geologist of Ohio, unaffectedly regrets that this beneficent gift of Nature was not reserved exclusively for domestic use. He bitterly reproaches the extravagant townships that gave away their gas for making glass, raising steam, and other trade purposes which could be served equally well with coarser fuel, until it was all gone. Very reasonably, Professor Horton describes natural gas as the best domestic fuel in the world. It is better than any artificial gaseous fuel; and he regards it as a wicked waste to use it for manufacturing purposes. In the latter case, the supply soon gives out; whereas for domestic use a good well might last for years. A house of moderate size can be kept comfortable, he says, with a natural gas consumption of from 500 to 1000 cubic feet per day; the price delivered being, say, 6d. per 1000 cubic feet, although as low a rate as 2½d. per 1000 cubic feet is mentioned for some parts of Indiana and Ohio. The calorific power of natural gas is taken at about 1100 British thermal units per cubic foot. Its local price is regulated by that of coal. Supposing coal to have a calorific value of 25 million heat units per ton, this weight of coal is practically equal in value to about 20,000 cubic feet of natural gas. This is the equivalent value of the two fuels accepted by the Pittsburgh glass trade. With so low priced a gas, consumers' meters are not commonly used; the rate of consumption being roughly determined by the size of the "mixer," or gas orifice of the atmospheric burners used. If the American and Canadian natural gas supply were carefully husbanded, and reserved for domestic use within the economical limits of pipe transmission, the result would be the finest demonstration in the world of the possibilities of gaseous fuel for this purpose. It is true that at first the gas would be used extravagantly, and the methods employed would consequently be worthless as guides to those whose gas supply is artificial and comparatively costly. But eventually the tendency to improvement and economy would operate to displace the

cruder methods, and the result would be a valuable object-lesson in the employment of this kind of fuel.

Besides natural gas, the typical American labour-saving way of house warming and cooking is by steam. Steam heating calls for a combined system of wholesale generation and distribution; because it is as easy, or easier, to make steam for a score of houses as for one. And when the houses are situated pretty close together, the problem of steam distribution among them is not difficult. We have noticed the operations of the steam heating companies of the United States on several occasions, because steam heat is really the only modern rival of gas heat. Commercially, steam distributing plants are only possible where there is a reliable and considerable demand for the heat over a tolerably long season, which is not the case in this country. The Gulf Stream restricts the steam heating company to its native shore; but there are countries of Europe where an enterprise of this kind might answer. Even in Great Britain, there are cases where a system of steam heating, of a semi-public character, might prove convenient—as, for instance, the heating of a range of college buildings, or a scattered factory, or residential block. If there is a simpler source of heat than the gas-fire, it is the steam radiator. It is worth knowing, therefore, what can be done by way of organizing a heating service by this agency.

An instructive example is that of the steam heating of the scattered buildings constituting Dartmouth College, at Hanover, N.H., a description of which has been given in "Engineering Record." The work was carried out during last summer, and at the beginning of winter fourteen buildings, containing in all 35,500 square feet of radiating surface, were supplied with steam by the central plant through 4200 feet of underground mains, varying in size from 12 to 3 inches diameter. The farthest building was 1977 feet from the boiler-house. The boiler-house contains four 125-horse power boilers, only three of which are ordinarily required. The chief problem was, of course, the conduit construction. For this purpose it was decided to use split sewer-pipes. The great point in this matter is to keep water away from the steam mains, which require, of course, to be amply lagged. In this case, the distribution being in private grounds, the object was to secure a conduit that should be accessible, cheap, and dry. Drain-pipes were selected for this purpose; each pipe, as moulded and before firing, being scored half-way through longitudinally. It was then baked and broken through completely into halves which were marked for going together again. The cut was given a downward slant, to throw off water. The object of scoring the pipe only half-way through was to keep it together for firing, and afterwards to leave a line of unglazed material that would hold the cement better. As laid, at every 18 feet a T-piece was used, with the outlet pointing downward. Inside this outlet a small pier of concrete was formed, carrying rollers on which the steam-pipes were placed. Thus the steam-pipes were free to expand or contract without reference to the conduit. The lower half of the conduit being laid in the trench, with the bearings in place, the steam-piping was placed in it and tested. After all leaks were repaired, the cover of the conduit was put on with cement, and the vacant space inside packed with granulated cork and infusorial earth. The trenches were bottomed and filled with sand and gravel, with a small pipe-drain underneath the conduit to take off surface water. All the steam-piping was laid with a fall back to the boilers, to take the condensation. So successful was the job that on the coldest day of last winter, when the temperature fell to $-23°$, there was a drop of steam pressure in the mains of $\frac{1}{2}$ lb. only.

Our contemporary criticizes the conduit construction in this example as being hardly the proper type, inasmuch as the steam-pipe cannot be readily got at for repairs. A tunnel big enough for a man to enter is recommended for this purpose; but this is obviously a very costly affair. Moreover, the plan of draining the steam-pipes back to the boiler is condemned, in favour of a system of trapping off the water. The return of the condensation water is usually effected by means of a separate small pipe. With regard to the proportion of steam radiators to the apartments heated by them, it appears that for small living rooms, with the radiators fixed below the windows, the American rule is 1 square foot of direct radiating surface to every 50 cubic feet of room content. For a public hall, the proportion of radiating surface to content is reduced to one-half.

For many reasons, the principle of heating by direct steam-radiators is likely to increase in favour where the conditions are suitable. The radiators are much less cumbrous than the old-fashioned hot-water pipes, and the heating is very economically done. At the same time, the fittings need to be good, and the cost of connections must therefore be rather high. For large residential "mansions," notwithstanding, steam heating is probably the only new system of warming that can rival gas-fires for cleanliness and saving of labour. For warehouses and offices, it is unobtrusive, safe, and capable of easy adjustment. The limits of adaptability of hot-water heating are soon reached; but those of steam do not appear to have been realized anywhere. This superior adaptiveness is due, of course, to the small mass of steam as compared with water. Our American engineering contemporary is collecting a valuable store of data respecting the methods and appliances for use in steam heating. The manner of jointing the flanged steam-pipes must be an important point. Further information on this head is desirable.

CONDITIONS OF LABOUR IN ENGLAND.

The Impressions of a German Coal Miner.

A FOREIGNER'S impressions of the conditions of life in our own country are always of interest, and, if the foreigner be observant and unprejudiced, may often be of use in correcting our own more partial views. Particularly may this be the case in regard to the conditions of labour and the attitude of employers and employed to one another. We are, as we have recently observed, not unnaturally liable to consider ourselves more hampered and oppressed by labour difficulties than our neighbours and rivals. An intelligent comparison of the industrial situation here with that on the Continent is therefore useful and welcome, especially when drawn by a working man who has had the opportunity of observing both situations from the inside. Such a comparison is drawn in a series of articles written for a Dresden newspaper by a German miner resident in Newcastle, and recently translated into English and published in book-form under the title of "How the English Workman Lives." The simplicity and homeliness of the language assures one of the genuine character of the book; and the writer's commeuts upon life in our working-class quarters are shrewd, and not infrequently humorous. The observation that, "as lotteries are forbidden in England, people resort to betting in order to get rid of their money," while displaying an apparent confusion of result with purpose, is really a neatly put criticism of the intelligence displayed in the gambling mania; and the remark that "to watch the behaviour of the Salvation Army for the first time makes a strange impression on a German," cannot be considered a harsh comment by a native of music-loving Germany.

The writer was born and brought up in Germany, and worked for some length of time in Cologne and in the Westphalian mines. But he was driven from his fatherland by the harsh treatment and want of freedom experienced there by the labouring classes, and came to settle in England. His verdict on the conditions of work, and the relations of the working and propertied classes in the two countries, is emphatically in favour of our own. "The position of the English miner is better than that of the German. That English workmen are not inspired with hatred of the propertied classes, results from the fact that the employer is much more humane towards his workpeople than in Germany. . . . . Here it is a real pleasure to work." The political and economical value of this humane treatment is observed, "It would be to the disadvantage of the working classes themselves to sever themselves in the matter of politics from the middle classes, since the attitude of the latter towards the workman has been friendly." Socialism is, therefore, unlikely to take any real hold of our working classes; whereas the contemptuous attitude of the employer to his men is, in Germany, a great factor in its growth. The great freedom enjoyed in England, both by the individual and by combinations of individuals, and the impartiality of justice, are also instanced as our safeguards against embittered class feeling. "The policy of repression pursued, on the other hand, in Germany, segregates and embitters the workman. He trusts no one who is not a workman. He reads socialistic papers and literature; and the more they revile the propertied class, the better he is pleased. Besides, every workman knows that he is everywhere shadowed by the police. . . . . England is at least fifty years ahead of Germany." Economically, too, we are the gainers by our greater consideration for, and better payment of, our men. "There is good reason why the English miner should be the older and stronger man of the two. He has time to rest properly, and he enjoys more meat than potatoes. Generally speaking, over-strain and under-feeding disable the German from competing with him. . . . I must repeat that the English workman is bigger and stronger than the German, and can work quickly and uninterruptedly during his short shift. Frequently he stands on a higher level educationally."

We are often told that the lower standard of living among the Continental labourers, enabling them to subsist upon lower wages than the English, is a serious handicap to our manufacturers in competing with the products of Continental labour. It is well to bear in mind that, especially in occupations entailing constant and considerable physical exertion, low-priced labour, like low-priced material, is not necessarily cheap. Superiority of workmanship is a valuable national asset; and though such superiority largely depends upon the well-trained mind of the worker, the advantage of the well-trained mind being supplemented by a robust physique must not be forgotten. As to the higher educational level said to have been reached by English working men, it must be observed that the writer is speaking from his experience of Northumberland miners, whose exceptional intelligence and desire for education are well-known. It has been no uncommon thing to find them at the end of a day's work, tramping three or four miles to and from a University Extension Lecture. Were all the working-men of this country to display the same zeal, the reproach of our inferiority to other nations in respect of working-class education would be soon removed. Altogether Herr Dückershoff's little book is a welcome warning against a despairing or too pessimistic view of our industrial future; and it affords considerable confirmation of the opinion recently expressed is these columns that the present industrial position of Germany in not destined to be a lasting one.

THE METROPOLITAN GAS CHARGES COMMITTEE.

The Select Committee presided over by Sir James Rankin, who were appointed at the instance of Mr. Cohen, "to inquire into the powers of charge conferred by Parliament on the Metropolitan Gas Companies, and to report as to the method in which these powers have been exercised, having regard to the differences of price charged by the various Companies," finished their labours on Saturday. Their report, which was laid upon the table of the House of Commons yesterday, was not available for publication in to-day's "JOURNAL;" but "The Times" states that it recommends that in future when a Gas Company applies to Parliament for further capital powers, only such powers shall be conferred as will satisfy the estimated requirements of the Company for five years. (It may be recalled that the Gaslight Company's Bill, recently rejected by the House of Lords, would have satisfied the estimated requirements for about eight years.) The Committee find that the Gaslight Company have not been managed with that due care and efficiency which was recommended by Mr. Cardwell's Committee as one of the implied conditions for the granting of the sliding scale; also that, through the Company having erected and used antiquated plant, and having laid out a good deal of capital which has proved unproductive, the shareholders have suffered, and as a consequence the price to the consumers has necessarily been raised, because the sliding scale operates in such a way that the price to the consumers depends upon the dividend paid to the shareholders. The Committee further suggest that the area south of the Thames which the Gaslight Company at present supply should be transferred to the South Metropolitan Gas Company; the latter Company paying to the former reasonable terms for the property taken over; and finally it is recommended that, as the conditions for the manufacture of gas have undergone so marked an alteration since the sliding scale and the standard price were fixed by Parliament, the standard price for all Metropolitan Companies as regards new capital should be lowered, and an additional sliding scale should be instituted whereby, besides the ¼ per cent. dividend which is allowed to be divided for every 1d. per 1000 cubic feet reduction in the price of gas, a further ¼ per cent. would be distributed amongst the shareholders for every 3d. per 1000 feet reduction. Thus, if the standard price were fixed, as recommended, at the uniform rate of 3s. per 1000 cubic feet, the South Metropolitan Company, who are now charging 2s. 2d., and are therefore entitled to pay 2½ per cent. above their standard dividend, would be enabled to distribute another ¾ per cent. in respect of the 10d. below the standard price at present paid by their customers. Conversely the Gaslight Company, who are now charging 3s., would be able to pay only the standard 10 per cent. dividend until (*a*) under the existing sliding scale they obtained ¼ per cent. for every penny reduction below the standard price; and (*b*) they reduced their price to 2s. 9d. and so became entitled to another ¼ per cent. dividend. It should be added, says our daily contemporary, that the Committee's recommendations in regard to the new sliding scale only apply to future capital; it being recognized that it would be unfair to vary the conditions on the faith of which capital has already been subscribed.

PERSONAL.

Mr. HENRY DIXON, of Bridlington Quay, has been appointed, out of 93 applicants, Gas Manager to the Conway Urban District Council.

Mr. D. H. ANDERSON, of Southampton, has been appointed local Manager of the Cagliari Gas and Water Company, in succession to the late Mr. Craig.

Mr. J. BYROM, the Chairman of the Gas Committee of the Bury Corporation, has been invited to accept the position of Mayor, in succession to Alderman Wike, who will complete his second year of office next November; and he has consented to do so upon the unanimous selection of the Council. He is also a member of the Electric Light Committee.

Mr. SYDNEY FRANCIS, who for the past five years has been chief draughtsman and outdoor inspecting engineer to Messrs. J. and H. Robus, has obtained the appointment of Gas and Water Works Manager to the Clacton-on-Sea Urban District Council, applications for which were invited in the "JOURNAL" for the 27th ult. Mr. Francis entered the firm he is now leaving about eight or nine years since; and he is the fourth of their employees who has been successful in obtaining a managerial position.

Mr. HARRY G. EDWARDS, who for the past six years has been on the staff of the Gorleston and Southtown Gas Company (five years as articled pupil and one year as assistant), has received the appointment of Assistant to Mr. A. F. Phillips, at St. Albans, advertised in the "JOURNAL" some weeks ago. The men at the above-named works have presented Mr. Edwards with a testimonial, consisting of a handsome clock and pair of gold cuff-links, as a testimony of the good feeling which has existed between them.

In noticing last week the changes in connection with the management of the Saltley Gas-Works, Birmingham, consequent upon the appointment of Mr. J. W. Morrison as Engineer to the Sheffield Gas Company, we remarked that it had not been determined whether Mr. Chaney, of Beckton, who had been recently selected to fill an important position under Mr. Hack, would succeed Mr. Morrison or take charge of the new works at Nechells. We now learn that Mr. CHRISTOPHER RICHMOND, who is at present the Resident-Superintendent of the Swan Village station, has been appointed Superintendent of the extended portion of the Saltley works. Mr. Richmond has been in the service of the Corporation as assistant to Mr. Hack, since 1892; and he was transferred from Saltley to Swan Village in 1897.

Personal estate of the value of £94,931 has been left by Mr. FRANK LIVESEY, whose will, in his own handwriting, is dated Dec. 29, 1896. The Executrix and Executor are his widow, Mrs. Georgiana Frances Livesey, and his brother, Mr. George Thomas Livesey. The testator has bequeathed to Mrs. Livesey his household effects and the balance at his bankers', subject to the payment thereout of his debts and funeral expenses. He has given to his widow a life-interest in the whole of his residuary estate, which, subject to such life-interest, is to be in trust for his children; and he has left it to her to decide whether or not she will divide a portion of the estate among them during her life. Mr. Livesey has recommended that his ordinary and debenture stock of the South Metropolitan Gas Company shall be retained in its present state of investment, and distributed among his children.

NOTES.

The Depreciation of Machinery.

In view of the controversy regarding the rate of depreciation that should be allowed on electrical and other machinery, attention should be given to a paper recently read by Mr. W. E. Cowens before the North-East Coast Institution of Engineers and Shipbuilders, on the subject of "Shop and Establishment Charges." The author pointed out that in all engineering works the cost of producing an article is made up of: (1) Direct cost of manufacture; (2) indirect cost through shop charges; and (3) indirect cost due to establishment expenses. Considerable uncertainty prevails as to the valuation and apportionment of the two latter elements in the calculation of cost. The direct cost includes wages, material, and everything that can be charged directly against the number of the order. The shop charges embrace the foreman's wages, despatch clerk, belts, tools, engine power, &c. These items can all be carefully taken out for each shop, but cannot be charged against order numbers. The establishment charges cover everything which is common to the whole works, such as rent, rates and taxes, salaries, advertising, lighting, and so forth. The writer discusses the incidence of these expenses for different shops. He points out that without care in this regard, dividends cannot be safely paid. He depreciates boilers at 7 per cent., engines at 3 per cent., and machine tools at 5 per cent. In order to avoid the disturbing influence of fluctuations in the cost of materials, all the indirect charges are, in Mr. Cowens' practice, worked out as a percentage on the amount of wages paid, which in turn are apportioned to the work actually turned out. According to this paper, establishment charges are taken at 65 per cent. The paper is given in full in "Engineering" for the 14th inst.

American Rules for Boiler Capacity.

The American Society of Mechanical Engineers have had a Committee charged with the revision of the Society's code of steam-boiler tests. In 1885, a Committee first prepared a set of rules for boiler testing, which covered the ground so far as was known. During the past thirteen years, methods and instruments have to some extent changed. Boilers are now sometimes made to show certain percentages of efficiency, instead of giving a specified evaporation. Moreover, the testing of flue gases has become common. Consequently the new Committee have formulated a revised code. The amendments relate to the use of improved steam calorimeters, to sampling coal and determining its moisture, to calorific tests and analysis of the coal, to analysis of flue gases, to smoke observations, and other matters. The Committee recommend that as far as possible the capacity of a boiler should be expressed in terms of the number of pounds of water evaporated per hour from and at 212° Fahr. Every pound of water thus evaporated is equivalent to 965·7 British thermal units. It does not seem expedient to abandon the term boiler horse power as a commercial unit of steaming capacity. Consequently the Committee endorse this unit, which they define as follows: The unit of commercial horse power developed by a boiler shall be taken as 34½ units of evaporation per hour—that is, 34½ lbs. of water evaporated per hour from a feed-water temperature of 212° Fahr. into dry steam of the same temperature. This standard is equivalent to 33,317 British thermal units per hour. It is also practically equivalent to an evaporation of 30 lbs. of water from a feed-water temperature of 100° Fahr. into steam at 70 lbs. gauge pressure. It is also laid down that a boiler rated at any stated capacity should develop this capacity when using the best coal ordinarily sold in the market where the boiler is located, when fired by an ordinary fireman, without forcing the fires, at a mean chimney draught of 0·5 inch of water. Under forced conditions of working, with the

same coal and fireman, the boiler should steam one-third more than its rated capacity.

Heat Absorption by Water Circulating in Tubes.

Mr. G. Halliday has discussed in "The Engineer" the heat-absorption power of water. The question to which he addressed himself was as to the utility of a rapid circulation of the water in tubular boilers as regards increased steaming. Some authorities have taught that the quicker the movement of water over the heating surfaces the better. Others have denounced circulation as an evil in itself. Mr. Halliday has conducted a series of experiments to decide the question. The apparatus consisted of a solid-drawn copper tube, with the necessary provision for a constant flow of water, arranged to be heated by a bunsen gas-burner giving 66 jets in a length of 2 feet. The water was caused to flow through the pipe at rates ranging from slow to quick circulation. At first there was a marked increase in the number of thermal units absorbed by the water with increase of velocity. After a point had been reached, however, the absorption began to show a falling off. When the results were plotted, the heat absorption curve showed a sharp rise to a maximum point, and then a gradual decline. Mr. Halliday concludes from all his experiments: First, that the absorption of heat by water, when passing through a glass or metal tube, and heated by steam or hot gases, is a function of the velocity of the water and of the quantity of heat present in the heat source; secondly, that the absorption increases with the velocity of the water up to a certain point which depends on the source of heat; thirdly, the absorption falls off after a certain velocity, and this appears to depend on the nature of the source of heat, and it may depend very considerably on the kind of motion which the water has in the tube. He wonders whether at these velocities the water moves rigidly through the tube; and if the drop in the power of absorbing heat is due to there not being time enough for it to be conducted to the inner layers of the moving water.

COMMUNICATED ARTICLE.

FURTHER OBSERVATIONS ON PURIFICATION.

By S. Carpenter, of East Ham.

About the year 1866, the writer's attention was specially directed to the subject of the purification of gas from sulphur other than sulphuretted hydrogen. He conducted a number of experiments in connection therewith, and is therefore in a position to point out, from practical experience, the causes of the failure of the system and the way to remove them, and also to indicate what, in his opinion, is the proper way of using the agents employed in the purification of gas from carbonic acid, bisulphide of carbon, and sulphuretted hydrogen. The causes referred to are the same now as they were when gas was first tested for bisulphide of carbon; and they have always been a source of anxiety. To ensure thorough purification, the gas should be first tested for bisulphide of carbon, and then the exact amount of sulphur may be ascertained. The process is as follows: Take a sample of coal, and use the experimental apparatus ordinarily employed for coal-testing purposes. Pass the gas into a small holder, and you will then have the pure crude gas. Test it in the usual way for bisulphide of carbon, and the exact amount of sulphur will be ascertained.

The question now arises: What explanation can be given in regard to the failure of sulphur purification? Let us confine ourselves to the bisulphide of carbon found in the crude gas produced from New Pelton, Londonderry, and West Leverson coal. The average quantity will be from about 38 to 44 grains in 100 cubic feet. If we find any more than this at the outlet of the lime purifiers, there will be something wrong, and we must look for the cause. It is not in the coal or in the lime. It may be explained in three ways. In the first place, when the coals are disturbed from their normal condition, the impurities begin to form, and bisulphide of carbon is one of them. In the first period of the charge, there is only a very small quantity of bisulphide given off; but subsequently there is more. After the volatile constituents of the coals have been expelled, sulphur is given off very freely from the newly-formed coke. If the heat is still made to act upon the coke, bisulphide of carbon makes its appearance very fast. Its production, therefore, has reference to the temperature employed in carbonization. The coke holds the protosulphuret of iron derived from the decomposition of the bisulphuret of carbon contained in the coal; and this sulphur combines with carbon to form bisulphide. Gas coke is exactly such a mixture of protosulphuret of iron and carbon as is here alluded to. Or it may be that some of the retorts are overheated, so as to get all the gas out of the coal. But heating can be carried too far. When all the volatile matter is driven off, the temperature of the retorts begins to increase very quickly, and then the sulphur is driven off from the coke, if it is allowed to remain in the retort. In the second place, the cause of failure may be little chinks or small holes in the retorts, through which the combustion products from the furnaces pass and mix with the gas. This would cause a large quantity of sulphur in the gas. It is well known that, when coke is burning, it gives off sulphur. In the third place, the failure may be caused by air passing up the ascension-pipes, or into the lime purifiers with the gas. The oxygen of the air converts into water the hydrogen which the sulphuretted hydrogen in the gas contains, and at the same time sets the sulphur free. The lime holds the sulphur, and instead of becoming and remaining for awhile what the writer terms hydrogenated sulphide of calcium, it becomes hydrated sulphide of calcium, which has not so great an affinity for bisulphide of carbon as the former material. The water is absorbed by the lime, which, of course, becomes damp instead of dry. This dampness interferes with the chemical action of the lime on the crude gas, and the working of the purifiers will be very unsatisfactory. If, when a purifier is out of action, the cover is raised, the lime will be found damp and very light in colour, instead of being dry and dark green.

The failures in the purification of gas from sulphur other than sulphuretted hydrogen which the writer has pointed out have been found from practical experience; and therefore he can speak about them with confidence. If the instructions he has given are observed, there will not be any difficulty in using lime for eliminating the carbonic acid and part of the bisulphide of carbon. Failure is not due to the lime not taking out these impurities, but to something passing into the lime purifiers different from the crude gas, which really prepares the material for its work. The use of lime is, however, attended with great disadvantage—first, because of its expense; secondly, by reason of the difficulty of disposing of the refuse; and thirdly, on account of the nuisance arising from the evolution of sulphuretted hydrogen during, and after, the operation of removing the foul lime from the purifier. In consequence of this nuisance, lime purification has become a source of anxiety to gas managers; but all this nuisance and anxiety can be avoided by working the lime and the lime purifiers by the "rotation" system, adopted by the writer, which consists in ventilating the purifier and at the same time revivifying the foul lime before its removal from the box, so that it can be used a second time. In working the process, it is necessary to have at the bottom of the side of the purifier a connection to a steam-jet exhauster; and the outlet of the exhauster should be in communication with a small purifier charged with oxide of iron, so as to purify the air which has been drawn through the foul lime. When the purifier is out of action, the plug in the cover should be drawn, and the steam turned on. This will draw the air through the foul lime, revivify it, and abate the nuisance. Care must be taken when starting the exhauster. A vacuum of 4-10ths will be sufficient. The cover of the purifier must not be raised until the exhauster has been at work for about six hours, or nuisance will be caused. After the exhauster has been running for the time named, the cover may be lifted, and the vacuum increased to 8-10ths. If too much vacuum is put on at first, there will be danger of raising the temperature to such a degree as to set fire to the grids—a serious consequence. If the air is drawn through the foul lime for about six hours, no nuisance will be caused when the cover of the purifier is removed. To revivify the lime, about 24 hours will be required. When it is taken out of the purifier, it should be spread out to the thickness of about a foot, exposed to the air for a day or two, and then turned over once or twice, a little water being added if necessary. Then the lime should be heaped up, and it will be ready for use again at any time.

The writer's method of working lime purifiers so that the lime may be used a second time is as follows: In charging the purifiers, put the lime which has been used once on the two bottom grids, and the clean lime on the top tiers. When emptying the purifier, keep the two layers of lime separate, so that the lime forming the top layers can be used again, and the others sent away as spent. If lime purifiers are worked in this way, the expense of purification will be brought down very much, and the nuisance reduced to a minimum. From the outlet of the lime purifiers the gas should be passed through a series of oxide of iron purifiers—say three—so as to remove the remaining sulphuretted hydrogen. At the inlet of the first oxide purifier, there should be passed in with the gas a measured quantity (about 2 per cent.) of air. When the sulphuretted hydrogen makes its appearance at the outlet of the first oxide purifier, send a small quantity of air in at the inlet of the second. If the gas is purified in the way described, the great difficulty which has been experienced in the purification of coal gas from sulphur other than sulphuretted hydrogen is removed.

A few hints may now be given on the preparation of lime for purification. Good burnt chalk lime is the best kind to use. Quick lime should weigh from 56 lbs. to 60 lbs. per bushel; if it weighs more than 62 lbs., the chalk has not been properly burnt, or it may have been of inferior quality. The writer has paid great attention both to the quality of the lime, and to the slaking of it. For the purification of gas from sulphur, one bushel of lime should be slaked. This operation will require from 4 to 4½ gallons of water, if it is good lime. After it has been properly slaked, it should measure 2¼ bushels, and weigh from 32 lbs. to 34 lbs. per bushel. It will then be in good condition for work. After the lime has been prepared for the purifier, it is well to take a handful and squeeze it. Some lime will feel sandy, which will indicate that it is not of the best quality. If it is good, it will feel soft to the hand. This will be the best kind to use. Great care should be taken in slaking. It is a good way to spread the lime about 10 feet square and 6 inches deep, and

throw water on it; then put another layer on the top of the first, and water it in the same way. This process should be continued until the heap is about 6 feet high. Then let it rest for a day, by which time it will be properly slaked. This will be the time to well mix it. To slake one yard of good lime will require from 85 to 90 gallons of water. In slaking the lime, be careful not to make it too damp. If it is too wet, it does not get into an active condition so quickly as when it is of the proper consistency. The weight of the lime, when ready for the purifier, should not be more than 34 lbs. per bushel.

It is indispensable that the whole of the carbonic acid should be removed from the gas, but not all the sulphuretted hydrogen, before it enters the second lime purifier. There should be sufficient of the latter, as already pointed out, to convert the lime into hydrogenated sulphide of calcium, which possesses in a high degree the power of absorbing bisulphide of carbon. A manager must not be misled by thinking that, if gas is purified solely by lime, the whole of the bisulphide of carbon will have been removed, as this will not be so. For instance, if lime is the only purifying agent employed, the material in the last purifier will be almost clean. A great deal has been said about sulphide of calcium for taking out the bisulphide of carbon. If crude gas is passed into a purifier charged with hydrate of lime, and allowed to act in its presence, it will soon be converted into hydrogenated sulphide of calcium. But reverse the order of things—that is to say—charge a purifier with clean lime, then pass into it gas which has been purified from sulphuretted hydrogen, and let the gas act on the lime for a week or more, and test it day by day for bisulphide of carbon, and the reduction will be from one to two grains per 100 cubic feet. Once more reverse the order of working. Shut off the clean gas, and then pass the crude gas into the purifier; and if the latter gas is allowed to act in the presence of the clean lime it will convert it into hydrogenated sulphide of calcium. Pure sulphide of calcium has little or no affinity for bisulphide of carbon in clean gas. The affinity of lime for carbonic acid is greater than for sulphuretted hydrogen; so the carbonic acid can be taken out of the gas by the lime in the first purifier, and the second becomes the hydrogenated sulphide of calcium purifier. When the first purifier is saturated to such an extent as to be no longer capable of efficiently absorbing the carbonic acid and part of the bisulphide of carbon, it should be thrown out of action without delay.

The following is a description of the lime method of purifying coal gas: From the outlet of the scrubber pass the gas into two lime purifiers. The work of the first is to decarbonate the gas, and at the same time it will remove a portion of the bisulphide of carbon. The gas will then pass into the second purifier free from carbonic acid, but with sufficient sulphuretted hydrogen to convert the lime into hydrogenated sulphide of calcium. When the lime in the first purifier is sufficiently foul, the vessel is shut off, the second purfier made the first, and a clean purifier put on for the second Two lime purifiers in action at the same time will be sufficient to eliminate from the gas the carbonic acid and two-thirds of the bisulphide of carbon. The size of the purifiers will be proportionate to the make of gas.

The method of employing lime purifiers here described has been carried on under the writer's direction for thirty years; and it is in operation at the present time. He believes that sulphur purification will be found not only more convenient, but also more economical, if the lime is employed in the manner described. In devising the process, he saw the importance of preventing carbonic acid from entering the second lime purifier; and he has practically carried the principle into effect. Care should be taken to eliminate the ammonia from the gas before it enters the lime purifiers. Managers have been advised to keep a little ammonia in the gas until the end of the process of purification, so that it may react in the presence of lime upon the bisulphide of carbon, and produce sulphocyanide of calcium. In the writer's experience, he has found it to interfere with the value of the lime for taking out the bisulphide. Hydrogenated sulphide of calcium is at present the only agent that will remove this impurity from coal gas; and it is produced, as already explained, by allowing the crude gas to act in the presence of hydrate of lime.

The object of the foregoing suggestions is to effect the absorption of the bisulphide of carbon, which is acid in its nature, by the alkaline hydrogenated sulphide of calcium, and also to permit the crude gas to act in the presence of the latter to absorb the bisulphide. The points to which the writer would direct attention are the following: Good condensation, and prolonged contact of the crude gas with the products of this operation—tar and liquor. This can be effected in vertical condensers and scrubbers, where the gas can be well washed with ammoniacal liquor and clean water. From the outlet of the scrubbers the gas goes into the lime purifiers, the first of which will decarbonate it, and the second remove the sulphur. It then passes into the oxide of iron purifiers to take out the remaining sulphuretted hydrogen. It is highly important to keep the furnace gases from passing into the retorts and mixing with the gas, and also to avoid the admission of air into the lime purifiers. Working the purifiers in the way described will, the writer ventures to think, be found the best way of purifying gas from all its impurities; and he commends it to the attention of students and managers as the result of fifty years' practical experience in some of the London gas-works.

TECHNICAL RECORD.

WESTERN (U.S.A.) GAS ASSOCIATION.

Annual Meeting at Milwaukee.

The Twenty-second Annual Meeting of this Association was held at Milwaukee (Wis.), on the 14th, 15th, and 16th ult., under the chairmanship of the Senior Vice-President, Mr. J. C. COPLEY, of Aurora (Ill.). Mr. G. T. Thompson, the President, was prevented from attending by illness. The Hon. D. S. Rose, Mayor of Milwaukee, welcomed the Association; and Mr. Paul Doty, of Grand Rapids (Mich.), made a suitable reply.

The Vice-President then read an address prepared by the President; prefacing it by reading a short personal note from Mr. Thompson, which recorded a gratifying improvement in health. The address commenced by a reference to the gas-works and the Gas Company at Milwaukee, especial allusion being made to the large consumption of gas for fuel. The difference between the minimum output in July and the maximum in December was only in the ratio of 1 : 1½; and the day output during eight months of the year was more than the night output. Turning to the affairs of the Association, the President thought there was yet room for a large accession of members, and considered some of the reasons why eligible parties still held aloof. Taking the attendance at the meetings during the last three years, it averaged about 30 per cent. of the members; but a large number of these only attended the first sitting. The number of speakers on all subjects was not over 12 per cent.; and the participants in authorship and debate included the same names year after year; showing that the burden of carrying on the work of the Association was borne by less than 15 per cent. A great need of the Association was that the members should do more than merely pay dues or passively attend meetings. He spoke highly of the value of the "Wrinkle" department, and urged the members to support it.

In the course of the business proceedings, the Association voted £20 per annum for five years to the Trustees of the Educational Fund of the American Gaslight Association.

Mr. Paul Doty, of Grand Rapids, read a paper on "The Causes Underlying the Formation of Naphthalene, and their Prevention," which trouble, he remarked, was experienced by water-gas makers as well as with coal or with mixed gas plants. With regard to the value of the Shadbolt process, a variety of opinions existed; and for the present he suspended judgment on it. Mr. Botley's system was next reviewed. The causes of the formation of naphthalene were considered; and the author pointed out that it made its appearance in connection with water gas at the time when heavier oils, necessitating larger superheaters, were substituted for light oils. With naphtha, an efficiency of 6 candles was quite possible in practice; and the tar was a negligible quantity. Using gas oil, his average for 1898 was 5·77 candles per gallon, and the production of tar 1½ per cent. of the oil. This oil-tar contained a notable proportion of naphthalene; as much as 10 per cent. having been claimed. A hot washer maintained at over the melting point of naphthalene—176° Fahr.—was one of the best preventatives of trouble; and in water-gas apparatus, he specially recommended that the temperature of the water in the seal-box should not be under 180°. At Grand Rapids he carburetted the coal gas with naphtha at the outlet of the Pelouze and Audouin condenser, where the gas, though free from tar, still retained a temperature of about 110°. He exhibited a table, based upon his own experiments, of the solubility of naphthalene in naphtha—s.g. 740°—at different temperatures, which showed that at 106° the liquid would hold 50 per cent. of naphthalene in solution, but at ordinary temperatures it had very little solvent action on naphthalene. The fact that naphthalene melted at 176°, enabled it to be easily flushed out and removed by steam or boiling water; and his experiments explained the efficiency of hot naphtha vapour. Two valuable communications on the subject of naphthalene had recently been published in the "JOURNAL OF GAS LIGHTING"—viz., an abstract of a paper read by Dr. P. Eitner, of Carlsruhe, and a paper on "The Relation of the Determination of the Vapour Tensions of the Condensible Hydrocarbons of Coal Gas to the Questions of Naphthalene Deposits and Benzol Enrichment," by Mr. Wilfrid Irwin. The last named showed that only about 25 per cent. of gas at ordinary temperatures was saturated with illuminating vapours apart from naphthalene, and proposed carburation with benzene as a method of replacing the naphthalene in the gas with benzene. Dr. Eitner recommended the judicious use of solvent naphtha as a carburetting agent, and quoted the price at 5d. per gallon. This the author considered a mistake, as he found that pure xylene—the base of solvent naphtha—cost 5s. per gallon. Crude solvents could be had at 1s. 8d., or even 1s. 3d. per gallon. An inquiry addressed to Dr. Eitner, elicited the reply that possibly the cost of solvent had been under-estimated, but pure xylene was not necessary, and the cost was not of primary importance, as a comparatively small quantity would answer the purpose. Dr. Eitner showed in his paper that the constituents of tar had a solvent power on naphthalene, which accounted for the known value of slow and efficient condensation. Some experimental results were then quoted, showing that benzene was the best solvent for naphthalene; solvent naphtha next; and then

gas naphtha, kerosene, and wood naphtha. Dr. Eitner recommended solvent naphtha as being cheap, and as least likely to affect the quality of the gas. He considered that 1 gallon was sufficient for the treatment of about 6000 cubic feet of gas. The use of liquid solvents required care, as some of them rendered the gas liable to smoke when burnt, and others reduced the illuminating power. It must be remembered that the secret of success with the naphthalene problem was not so much the taking of it out of the gas, as the retaining of it and utilizing its valuable illuminating power.

Mr. Witherby said he had treated his gas at Lockport with naphtha at the outlet of the Pelouze and Audouin condenser; the temperature of the gas being 134° to 136°. Using the Standard Oil Company's 63° naphtha, he obtained very satisfactory results; but another grade of naphtha was found to be utterly useless. About 3½ gallons of the 63° naphtha per 100,000 cubic feet of gas was quite sufficient. Mr. Gimper said that it was impossible to avoid making naphthalene with modern high heats, and that the methods described simply aimed at its removal. He preferred the use of gasoline at the holder outlet, and believed that much of the naphtha added at high temperatures was absorbed by the tar and removed without doing any useful work. Mr. Runner found that naphthalene troubles came with the introduction of full-depth regenerator furnaces. The application of naphtha in the proportion of 3 to 4 gallons per 20,000 cubic feet of gas proved an effectual cure. He had an air-condenser, a hot washer, and a multitubular condenser; and he found that if the gas was reduced to 65° before reaching the outlet of the latter, no trouble was experienced. If, however, this temperature was exceeded, traces of naphthalene soon appeared. Mr. Barthold remarked that the effect of admitting small percentages of crude water gas into the coal-gas retorts was a loss of about 0·3 candle in illuminating power for each unit per cent. added. Mr. Mitchell had found the Shadbolt process a success with coal gas; but it did not answer with water gas. Mr. Chollar remarked on the properties of naphthalene, and said that the only practicable way to control it was to keep it in solution with some other vapour. Mr. M'Clary spoke highly of the use of the steam carburetter as a means of preventing naphthalene deposits. He used 74° naphtha evaporated at a temperature of 185° Fahr., and quoted some experiments which showed that the naphthalene was carried through to the burners and not deposited in the syphons. Mr. Wheeler also quoted an example of naphthalene disappearing from mains in a manner that could only be accounted for by supposing it to be carried through to the burners. Mr. T. D. Miller remarked that it had been shown that when moisture was deposited from the gas the naphthalene went down too, which explained why variations of temperature gave so much trouble. Anything that increased the variations of temperature or the moisture—such, for instance, as a steam-jet exhauster—also increased naphthalene troubles. He had heard of a process in which a portion of the gas compressed to 80 lbs. per square inch was used to atomize the naphtha and inject the same into the bulk. The result was a total prevention of naphthalene troubles; but there was a copious deposit of water. Perhaps the expanding gas produced a sudden reduction of temperature sufficient to throw down the moisture, and with it the naphthalene. He had no trouble except in localities where a sudden reduction of temperature took place. Mr. Fullerton, after trying naphtha, alcohol, &c., for cleaning stopped services, found there was nothing equal to boiling water.

Mr. Doty, in replying, admitted that the quality of the solvent naphtha would vary in an inexplicable way. He found the troubles arose chiefly at the changes of seasons, and especially in the autumn. In the Botley process the oil was atomized by pumping, and not by gas under pressure. The use of benzene at the gasholder outlet was liable to give a smoky gas. He could not explain why Botley's and other carburetting processes were a success, as his experiments showed that, at ordinary temperatures, naphtha had but little effect on naphthalene.

Mr. B. E. Chollar, of St. Louis (Mo.), read a paper on "A Foundation that Failed, and the Lesson it Taught." He deplored the meagreness of literature on the stability of natural earth for the support of foundations, and especially the relationship between foundation area and linear dimensions. But the differences between a load of one ton per square foot applied to a small area—say one square inch—and a large area of 10,000 square feet, were very different. In 1896 he built a tank 128 feet in diameter by 31 feet deep, representing, when filled, a load of a little over one ton per square foot, on ground that had previously stood a load of 4 tons per square foot without showing signs of weakness. But before the tank was filled, it settled on one side to the extent of 8¼ inches, throwing the top of one column 2 feet out of plumb. Fortunately the guide framing was not supported by the tank, so no structural injury resulted. The tank was emptied, jacked up into place, the sunken portion of ground filled up with sand, a row of sheet piling put close round outside, a few re-adjustments made to the framing, and the tank was refilled and the holder put to work and it had remained in satisfactory operation to the present time; being only about 1 inch out of truth. He contended that if the columns had been fastened to the side of the tank, instead of resting on a broad flange which formed the bottom member, a rupture of the tank would have resulted.

A paper on "Cyanides in the Gas and Waste Products at Columbus, Ohio," was read by Mr. E. E. Eysenbach. He had never found ferro or sulpho cyanides in crude gas; but cyanides were always present. The average of two tests showed 315 grains HCN. per 1000 cubic feet of gas at the inlet to the washer-scrubber and 308 grains at the purifier inlet. Some samples of oxide prepared on the premises from cast-iron borings, and holding 30 per cent. of sulphur, contained about 0·3 per cent. of sulpho-cyanides and 3·4 per cent. of ferro-cyanides calculated as Prussian blue. The gas at the outlet of the purifiers contained 43 grains HCN. per 1000 cubic feet. It appeared that practically all the cyanides reached the purifiers and were chiefly absorbed there; so they might be obtained either from the scrubbed gas or from the spent oxide.

Mr. Atwater said that with the gases from retort coke-ovens he recovered from 1½ to 1¾ lbs. of ferro-cyanide per ton of coal. Working anything under 200 tons of coal per day, it did not pay to extract cyanides; but the case was different with anything over 500 tons a day. Mr. Warmington said that the cyanide compounds would be found mostly in the hydraulic-main liquor. Mr. Lynn thought that, the higher the heats, the greater the formation of cyanide.

Mr. Eysenbach, in replying, said that he did not test the hydraulic liquor. He believed in Europe as much as 8 to 15 per cent. of cyanides was found in the oxides. He could not account for his results being so low; but the tests were carefully made, and he believed they were correct.

The subject was thought to be of some importance; and a Committee was appointed to investigate and report at the next meeting.

Mr. F. B. Wheeler, of Binghamton (N.Y.), read a short paper entitled, "Problems in New Business: Some History and Experiment." He advocated liberality in dealing with consumers, so as to secure popularity, and especially attention to small consumers. He was in favour of gas-pipes and fittings from main to burner free of cost. In a city of 45,000 population there might be 2000 unpiped houses on the lines of the gas-mains. These could be fitted complete with meter, fixtures, and cooking-stove for £9 per house, or, say, £18,000. If each house used only 4s. 2d. worth of gas per month the income would be £5000, and the net profit not less than about £1200. The capital could be raised at 5 per cent.; so that after paying interest, a balance of £300 would remain. The accounts for this class of business should be kept separate, as a means of showing, when necessary, what the gas company had done for the working man. A good canvasser was necessary; and he should be followed up by the best of materials and workmanship. At Binghamton, with a population of 42,000, there were on May 1, 1898, 21½ miles of mains, an average of 85 consumers per mile, of whom nearly half used less than 4s. 2d. worth of gas per month in the summer, and but few stoves. He first made a house-to-house canvass, ascertaining if the house was piped for gas, if a cooking stove was used, number of burners, and number of rooms in house. In one district of 1900 houses, 1200 were not fitted for gas. Of these, 100 were willing to have it right away, and 140 wanted it, but were not willing to pay for fittings. He then adopted a policy of fitting up houses free; the only condition being that the consumer agreed in advance to use gas for three years, and to pay for 1000 to 1500 cubic feet of gas per room fitted. An advertisement was issued setting forth these facts, together with the offer to lay services free if applied for within three months, and to supply a cooker free if its value in gas was paid for in advance, and a three years' agreement signed. Copies of agreements embodying these conditions were exhibited. The expenditure in fittings was carried to a suspense account and reduced by a fixed percentage annually. This plan secured 600 consumers in six months. After this a permanent canvasser was retained, whose work it was to follow round the non-consumers in rotation, as shown by the forms obtained in the preliminary canvass. These were bound in books with perforated leaves, and thus formed a permanent record of the state of business. From it lists could be prepared showing the number of services, stoves, &c., in each street, and the position of affairs in any locality could be obtained at a glance. In concluding, the author exhibited some specimens of attractive advertisements. A diagram was on view showing the possible business in his district as compared with the actual business obtained.

The President having invited discussion, Mr. Doherty said that any reasonable plan for increasing business would pay if sufficient push was put into it. The secret of success was to give satisfaction, and to remedy complaints both real and imaginary. As to free piping, make gas popular and the landlords will have to do the piping. He believed in almost every form of advertisement, and it was also convenient to have the friendship of the newspapers. An important point was to know every house in the district, who owned it, who lived in it, if gas was laid on, and so forth. The sales of gas were to some extent due to the personality of the management, but were also affected by local circumstances, and would always show wide differences even in places apparently of similar size and circumstances. Cheap gas was not everything. A well-cared-for consumer paying 5s. 3d. per 1000 cubic feet for his gas was better off than one who was supplied at 4s. 2d. but received no attention. Another point was that, with cheaper gas, more care and skill on the part of the users, and improvements in stoves, the income per stove did not figure out to more than a third of what it used to

be. Mr. G. M'Millan, while thinking that indiscriminate free piping might result in considerable loss, agreed that a liberal policy always paid, and that it was worth while to incur considerable outlay in securing public good-will. Thorough canvassing, advertising, and keeping the gas company constantly in public view was the way to success. Mr. Whipple said that in 1895 he advertised that he would supply and fix a stove free to anyone who would pay its value in gas in advance. He supported bold and liberal advertising. Mr. Howard suggested whether the effect of doing so much free, gratis, and for nothing did not tend to make old consumers who had paid for the same conveniences discontented, and inclined to think that the charge for gas, if it covered all this and a profit besides, was too high. Mr. Miller had found that with the free gas, or gas paid for in advance, it was very necessary to have a time limit, or a minimum consumption per month. Mr. M'Clary considered the best means of promoting business was purely a local question, calling for careful study of local conditions, and intelligent action thereon. Free services, &c., might do in one place and not in another; and in many cases a large payment in advance would be an objection—a small periodical payment covering everything being what was wanted. He found the plan of accepting payment for stoves by instalments, with a double commencing payment, to be a success; and he put the stove at half list price. Mr. Murdoch thought the lighting department had been overlooked, and advocated renting out Welsbach burners. Mr. Doherty, in reply to a question, advocated sales of gas for fuel purposes at special rates. The Vice-President emphasized the effect of local conditions, and did not believe that differences of consumption necessarily meant differences of management. The habits and character of the population had a great effect upon their gas consuming capabilities. He agreed that people did not always fully appreciate a "free" gift.

Mr. Wheeler replied, and said he had not pointed out in the paper that the advance payment was accepted in instalments, and this met the objection raised by the Vice-President and others. He also reminded the meeting that the "free service" was not a permanent thing in his district, but simply a special offer available for a limited time only. It was a sort of advertisement, and a means of educating the consumers and their neighbours.

(To be continued.)

THE HASTINGS CARBURATION PROCESS.

The present summer weather has brought with it to many gas managers the old trouble of naphthalene deposits; and the result has been revived attention to the carburation process introduced by Mr. C. E. Botley at the Hastings Gas-Works, as evidenced by numerous inquiries on the subject which he has lately received. In these circumstances, it may be of interest to give the following particulars which Mr. Botley has sent us on the working of the process.

Year ending Dec. 31, 1898.

Cost of oil received for the process	£67 7 9
Less allowance for oil finally used for other purposes	17 6 7
Actual cost of oil for the process	£50 1 2
Gas sold	380,947,000 c. ft.
Number of consumers	8,056
Cost of oil per 1000 c. ft. of gas sold	0·032d. [about 31,000 c. ft. for 1d.]
Oil used per 1000 c. ft. of gas sold	0·0078 gall.
Gas carburated, or "fogged," per gallon of oil (approximately)	128,000 c. ft.
Number of complaints of short supply from all causes	616

The whole of these complaints, averaging 1·68 per day, are practically accounted for by causes given, as water, &c., and appear to be inseparable from the distribution of gas.

For the sake of comparison, we give the figures for the year previous to the introduction of the process (1895) as follows:—

Stoppages	7,125 (average 19·52 per day)
Number of consumers	6,519
Gas sold	342,657,000 c. ft.

In the following table of results, the first sets of figures are for the years before the process was in use.

Table of Results.

Year.	Number of Consumers.	Gas Sold. Thousands.	Stoppages. "No gas."	Complaints of Short Supply.	Average Number per Day.	Maximum Number in One Day.
1893	6084	321,969	4948	..	13·55	97
1894	6143	325,485	4167	..	11·41	228
1895	6519	342,657	7125	..	19·52	129
1896	6997	348,771	..	1667	4·55	21
1897	7626	366,427	..	768	2·10	6
1898	8056	380,947	..	616	1·68	..
1899 to June 30	8343	200,075 six months	..	239	1·32	..

Cost of Oil per 1000 Cubic Feet of Gas Sold.—Year, 1896, 0·173d.; year, 1897, 0·028d.; year 1898, 0·032d.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

The members of this Association paid a visit last Saturday to the works of Messrs. R. & J. Dempster, Limited, at Newton Heath. They were received by Mr. Robert Dempster, Mr. Hepworth (Manager), and Messrs. Linton and Wild (Chief Draughtsmen).

The hydraulic riveting-machines were first inspected, and were seen to be doing their duty admirably; working at a pressure of about 1500 lbs. per square inch—a clear advantage over hand labour. Passing on, the furnace and roller for bending angle-iron and the punching and shearing machines of all sizes were reached. One of the punching-machines, capable of making 30 holes at once, is employed chiefly for producing gasholder plates. The welding-shop was next visited; the heating being done by water gas. Mr. Dempster briefly remarked that there was a good field for water gas for this kind of work in establishments sufficiently large to erect an installation. Passing by the smithy, containing the rolling-machines for boiler-plates and so forth, the erecting-shop—a very fine structure, there being plenty of room and light—was entered. Here the party saw in course of construction gasholders, purifier-covers, hydraulic mains, boilers, and tar-stills. The party were next taken to the gas-making plant, consisting of a Dellwik water-gas apparatus, a small bed of horizontal retorts, and another of inclined retorts; the two latter being used mostly for experimental work. Passing on the machine shop was reached—a striking feature being the horizontal lathes employed to face centre-valves and covers. The planing-shop, where the retort mouthpieces and the sides of purifiers are dealt with, was next visited; other portions of the works inspected were the pattern-shops and store-rooms, and the iron and brass foundry. From the latter place, the party returned to the offices, where light refreshments were provided. A hearty vote of thanks was proposed to the above-named gentlemen. Mr. Dempster, in reply, said it gave him great pleasure to take the party round the works; and he expressed his approval of the objects of the Association. After a few remarks by Mr. Hepworth, the interesting and instructive visit was brought to a close.

In the evening, the members met to hear a paper by Mr. Garlick on "Distribution." In introducing the subject, the author said that, from many years' experience, he found that the majority of the complaints made as to faulty pressure and the bad illuminating power of gas, were the outcome of want of thought in our predecessors, in the shape of too small mains, defective service-pipes, and internal fittings being, as regards size of pipes, out of proportion to the number of burners to be supplied. It would be his endeavour to offer a few observations upon these matters, in the hope that they might be of some practical use to the members.

With regard to the question of mains, to apply any principles of proportioning them in districts supplied by the works which had been in existence many years, would be a difficult undertaking, inasmuch as the network of pipes attained such huge proportions that to re-arrange it would be a matter of great cost and time. The most ready means of remedying defects in such districts, therefore, was to have recourse to the pressure-gauge; determining by its use the particular point where the pressure decreased, and, considering the consumption of the district, enlarging the mains accordingly. In the case of a new district, by noting the number of houses, shops, mills, and public lamps, one could easily determine the size of main required. In estimating for a new district, the author was not aware of any fixed rule; but, in his opinion, the best way was to take a census of the houses provided with fittings, the number of burners per house and in mills, and the number of public lamps, and then take for houses 1000 hours, for mills 500 hours; and for public lamps 4000 hours per annum, total up, and average each burner at 5 cubic feet per hour. This would give the estimated consumption. Then to this add 30 to 50 per cent. for future requirements.

Having decided on the size of mains required, the next thing to be done would be to get out the estimates. They should first ascertain the weight of the pipes required, which was arrived at by the following formula:—

$$W = 2{\cdot}45\,(D^2 \delta^2)$$

where D = outside diameter of pipe in inches, δ = inside diameter, and w = weight of pipe in pounds per foot. The second matter to be considered was the lead for making joints; and the third, the items of cartage and labour, cement, yarn for joints, and supervision and contingencies. After having ascertained these, the next point was to decide on the maker, and see some of the pipes tested. Having done this, and brought the pipes alongside the trench, everything would be ready, providing a sufficient set of tools had been obtained—such as planks for the sides of the trench, picks, shovels, bladders, clips for making joints, caulking tools, &c. If any of these things had been forgotten, the waste of time would upset all the calculations. In laying the mains, they should have a slight fall. Some engineers preferred 1 foot in 400 yards; others 1 foot in 250 yards. In hilly districts, the latter would come rather expensive for large pipes. A good plan for facilitating an even laying of a pipe was to take the difference in the levels at the end of a street where the main had to be laid, and ascertain the

length between the points of the levels taken. For example, suppose the street was 200 yards long, and the difference in level was 25 inches, this would work out to 0·125 inch, or ⅛ inch per yard. For a 9-feet pipe it would be ⅜ inch. Each pipe should have a prepared bed, and, if not of clay, the pipe should be covered with clay to preserve it. Testing the joints of the pipes should be done either with a pair of bellows and a pressure gauge, or by the leakage of gas. The author strongly recommended that as each main was laid it should be marked on an Ordnance map; and the size of branches, depths, &c., should also be noted. By doing this, great delay was avoided in searching for a main the exact location of which was not known.

Passing rapidly on to the question of services, the author said that in this particular department it might be as well to remark at the outset on the want of thought displayed by architects in their estimates. He said he had known places where a 1-inch service had been considered sufficient to supply seven semi-detached houses, each requiring a 1¼-inch service. Numerous similar cases had come under his observation. In getting out the sizes of mains, they should consider the number of lights required, and the gas-fires, cooking-stoves, &c., contained, or likely to be contained, in each house, also the length of the pipe from the main to the meter.

The author then made a few remarks on dip-pipes and syphon-boxes, and on internal fittings, which he said were generally accountable for complaints. He concluded by pointing out the benefit to be derived from working with the men.

The paper gave rise to a lengthy discussion, at the close of which the usual vote of thanks was accorded.

WATER-GAS PROCESSES IN GERMANY.

An interesting paper on the position of water-gas was read by Herr GERDES, of Messrs. Julius Pintsch & Co., of Berlin, before the Mark Association of Gas and Water Engineers on the occasion of their meeting in Berlin this year.

The paper dealt in the first instance with the modified Lowe carburetted water-gas process, which is so extensively used in England. The author pointed out that the German import duty on petroleum oils of a grade suitable for use in this plant amounts to 12·5 marks per 100 kilos., or to three to four times the value of the oil. The use of American or Russian petroleum for gas manufacture in Germany, therefore, appears out of the question; and as the native petroleum or shale oils are expensive and inferior, attempts have been made to carburet water gas by other agents—such as vaporized benzol. But water gas thus carburetted loses its illuminating value after a time, because the benzol vapour condenses from the gas. If, however, water gas carburetted with benzol is mixed with coal gas, the mixture retains the benzol vapour. Water gas carburetted with benzol has a calorific value per cubic foot from 45 to 60 calories less than common coal gas, though the ordinary carburetted water gas made with petroleum has nearly the same calorific value as coal gas. Therefore water gas carburetted with benzol would be consumed in greater quantity than coal gas for all heating purposes. The particular form of the process adopted for manufacturing water gas must depend on whether there is any use for producer gas; as if there is not, the bed of fuel is more rapidly raised to the proper heat by burning a portion of the carbon to carbonic acid during the blows.

Messrs. Pintsch have lately erected at Fürstenwalde a new water-gas plant, in which the producer gas which is formed as a bye-product is designed to be utilized for driving gas-motors. Experiments were first made on a Deutz benzene motor, which happened to be at disposal; and though it was not well adapted for the purpose, they proved so favourable that the consumption did not exceed 125 cubic feet of producer gas per effective horse power. Then two gas-engines, each of 150-horse power, were obtained. These engines are to run dynamos; and the current generated is to be used on the works—which, roughly, extend for nearly a mile—for both lighting and motor purposes. The producer gas used in the experimental work was derived from coke, and contained 23 to 24 per cent. of carbonic oxide. The new water-gas installation, which at the time of the writing of the paper was about to be put to work, has been designed to consume coal. Two generators are to be used in conjunction with one another; and the water gas formed in one is to be passed through the layer of coal with which the other has been recently charged. The coal will thus be partially gasified by the hot water gas; and the gasification will be completed at the next blow. The products of carbonization of the coal will thus be partly obtained in the water gas, and partly in the producer gas; and as the latter is to be utilized in the gas-engines, there will be no loss of energy due to waste of these products. It has, however, been found possible, by careful alternation of the charging and gas making in two water-gas generators, to obtain nearly the whole of the products of carbonization of the coal in the water gas.

The use of uncarburetted water gas for technical purposes, and for heating and lighting, has been undertaken on both a large and a small scale since 1885; and in many cases the water-gas installations have completely fulfilled their purpose. In other instances, however, the results have not been satisfactory, as the water gas has been found to behave very badly.

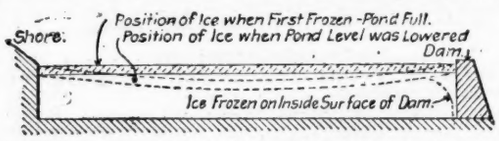
INJURY TO A DAM BY PRESSURE OF ICE.

Early on the morning of April 30, a section of the upper dam in the extensive works of the St. Anthony Falls Water Power Company at Minneapolis gave way, causing considerable loss to the owners, and some temporary inconvenience to the milling interests depending upon the water power. The causes of the failure were dealt with in a recent number of the "Engineering Record," from which the following particulars are taken.

The main falls at Minneapolis were, in 1877, protected by a roll dam and apron, from either end of which there extended up the river a series of dams serving to divert the current towards the east and west sides of the stream forming two mill ponds. In ordinary stages of the river, practically all the water in the Mississippi is utilized, and the apron is dry; but in flood stages there has been as much as 9 feet depth on the crest of the dam. To assist in the discharge of these flood waters, two additional spillways were constructed at the east end of the apron. The upper dam maintains the level of the water in the mill ponds from 10 to 12 feet above the crest of the apron. The main current of the Mississippi is towards the westerly shore; and by far the larger part of the power afforded by the works is utilized by the flour mills on the west side.

In 1893-4, a section of the upper dam extending from the west end of the apron for 530 feet up stream, and nearly parallel with the west bank, was rebuilt in a most substantial manner from plans by Mr. W. De la Barre, Engineer of the St. Anthony Falls Water Power Company. The material was Kettle River sandstone; and the specifications called for first-class coursed ashlar masonry. Much of the stone was in blocks weighing upwards of 8000 lbs. The dimensions were: Height, 18 feet; width at base, 12 feet; top, 5 ft. 1½ in. A spillway about 50 feet in length, and the same distance from the apron, afforded a means of removing logs and *débris* and of relieving the surrounding structure in times of high water. This dam was not expected to carry water over the crest; but in the unprecedented flood of 1897, 2 feet of water flowed over it for a considerable time without causing the slightest injury.

But the dam was destined to be subjected to an entirely unexpected strain. The winter of 1898-9 was the most severe which the North-West has experienced probably since the earliest settlement. For the first time in the recollection of those who have had to do with the works about the falls, the ice formed in the mill pond to the thickness of 6 feet—in fact, the cold was so intense that there was ice on the inside of the stone dam to the bottom of the river. Ordinarily the pond is open—owing to the brisk current—or only lightly frozen. The ice alone would not have caused any injury, had it not been for the fact that the level of the water in the pond is frequently changed. When all the mills using power are running, the level drops to the stage which the volume of water then in the river can afford; when the mills are stopped, as on Saturday night for the Sunday rest, the water rises until it flows over the spillways. A difference of level of several feet thus occurs at not infrequent intervals.


Position of Ice when First Frozen - Pond Full.
Shore.
Position of Ice when Pond Level was Lowered
Dam.
Ice Frozen on Inside Surface of Dam.

It follows, of course, that when the pond is frozen over at the highest stage, a lowering of the water gradually would cause the ice to sag in the middle while adhering to the sides. Continued cold would solidify the ice anew in this position, filling any cracks and adding to the thickness. When the water rises again, the concaved mass of ice must crush or extend itself laterally; and one end of the mass being against the solid shore, the whole force would be exerted against the dam on the outer side of the pond. As the pond is some 300 feet in width, every rise of water produced an enormous thrust. Under ordinary conditions, the thin ice would crush under the strain; but ice from 4 to 6 feet thick proved stronger than the dam.

During the very coldest weather, it was discovered that the dam was slightly out of position; but owing to the temperature it was impossible to examine the foundation and determine the extent of the injury. However, as much ice as was possible was removed, the dam settled back to its proper position, and at frequent intervals 3-inch steel rods were sunk through the masonry, and from 2 to 3 feet into the limestone ledge underneath. These were thoroughly set with cement. With the disappearance of the ice, the dam seemed in good condition; and at the time of the failure it was carrying only a few inches greater head of water than had been sustained without injury during the few weeks preceding. The break came without warning. A mass of masonry, 170 feet long, was tumbled into the basin in a few seconds, while a section 30 feet long, next the apron, was swung bodily like a gate on its hinges so that the outer end stood about 5 feet out of line. The steel rods which had been inserted were snapped off like straws.

Until a coffer dam can be constructed and the foundations at the break examined, the exact conditions and causes cannot be determined; but it is evident that the action of the ice, forcing

the top of the dam outward, opened a seam somewhere near the base on the inner side. The presence of water in such a crack would, of course, greatly weaken the structure. That the steel rods failed to compensate for this weakening is now evident.

The Water Power Company have already commenced the construction of a coffer dam about 900 feet in length, which, when finished, will allow of draining the part of the pond adjacent to the stone dam. It is estimated that the loss occasioned by the failure will amount to about $25,000.

SUBWAYS FOR STREET PIPES.

At the last Meeting of the American Water-Works Association, Mr. H. C. Hodgkins read a paper on the subject of "Substructures in Streets." The following abstract of it appeared in a recent number of the "Engineering Record."

The author does not approve of the plan usually adopted in substructures of streets—viz., building a large tunnel down the centre; but, as the result of long experience in constructing municipal works of various kinds, he advocates a dual subway in each thoroughfare. The scheme generally carried out is to devote the lower portion of a large tunnel to carrying sewage, which necessitates placing the bottom on the proper grades for such service. The portion of the tunnel above the sewer proper is generally planned to correspond with the Paris cross section, which has a shelf on either side of the channel for sewage, and a large arched space above for the various conduits to be placed underground. The sides of the tunnel must be pierced for all service-pipes, lateral drains, electric conduits, and hydrant branches. This plan, according to Mr. Hodgkins, presents many difficulties of construction, and in most cases would mean the rebuilding of the greater portion of the sewer system and much of the other work now in use, as the tunnel would have to be beneath all existing structures, or else occupy much of the space they now take up. This plan, he says, really gives no relief as far as sewers are concerned, as there would probably be more trouble in keeping the tunnel in repair than is experienced with the sewers as they now exist. There would also be as much trouble with all the laterals as occurs under the present arrangements. Great difficulty would be experienced in providing means of access sufficiently large and numerous. In many places it would be very difficult, if not impracticable, for the bottom of the tunnel to conform to the grade of the sewer without greatly detracting from the use of the tunnel for other purposes.

Mr. Hodgkins recognizes that the proposition to utilize the space below the sidewalks for subways would meet with serious objection from the owners of abutting property, who have already acquired vault privileges and similar rights, and in many States have had their possession of the street to its centre line upheld by the Courts. It is acknowledged that this objection may be insurmountable in some places; but the use of the space for subways offers so many advantages, in the author's opinion, that he examines such a project in considerable detail. These subways are to have vertical walls. In narrow streets, where more space is necessary than the width of the walk will afford, the wall may be placed in the street, and the narrow strip of pavement between the wall and the kerb built on a floor carried by heavy girders. Frequent manholes and skylights are to be provided. Street intersections should be crossed by tunnels of similar proportions. The plan does not contemplate the removal of large trunk sewers from their present locations in the centre of the streets. In large cities, these main sewers have already been constructed to a considerable extent; and there is rarely any occasion for digging up the street in order to repair or clean them. The smaller sewers, however, so far as grades will permit, should be the first thing to construct in the subways. They should be built on such grades, and given such proportions, as to provide for all the needs of blocks for which they are planned. As often as considered necessary, they should discharge at street intersections into the main sewers. In most places all sewers 2 feet or less in diameter should be placed in these subways; larger sewers would be constructed as now in the centre of the street.

Above the sewers, and so supported that thorough inspection can be made, there should be placed the water-mains, high enough to leave ample room for the house drains to pass under them to the sewer. Above the water-pipes should be placed the gas-pipes, those intended for steam heating, and other conduits of a like nature. Near the top should be located all electric conduits. At the street intersections, special manholes for access to the valves should be provided instead of the usual valve-boxes now in use. Fire hydrants could be placed as at present, and a special drain-pipe provided to empty their barrels (after use) into the sewer. It is probable these subways would not furnish sufficient room for the principal conduits bringing water from its source of supply; and in a few streets resort would still be necessary to the space below the pavement.

It is not considered desirable that the present mains should be disturbed until the opening of the street affords a convenient opportunity, or occasion arises for alterations or repairs. All service-pipes, conduits, and drains would run directly from these subways into the cellar or basement of the houses; and all pipes would be readily accessible for making such connections without inconvenience to anyone. The pipes and their branches could be easily examined; and the most rigid inspection and care would be needed, and should be exercised, for the prevention of leaks. Arrangements for ventilation could be made without difficulty.

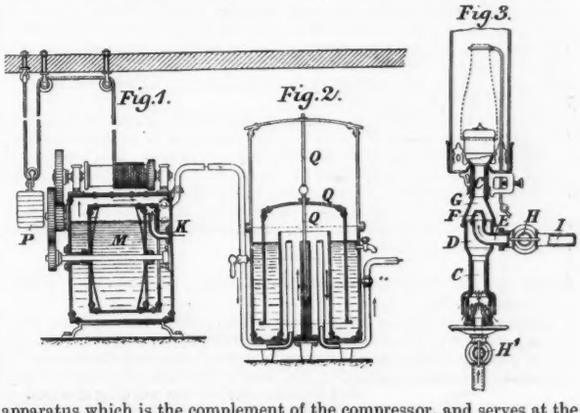
An objection to this system is that it duplicates work in each street. It is claimed, in answer, that in many streets in large cities water and gas mains are already duplicated; while the number of electrical conduits would seem to make duplicate systems very desirable. Moreover, such duplication would permit the use of smaller pipes, which are more easily handled and cared for. The shortening of the service-pipes would be no inconsiderable item. The ease with which any sort of pipes or conductors could be installed in such a system of subways, and the ample space for such installations which the sidewalk subways afford, are arguments advanced in favour of their construction. A special advantage which they afford in the case of large cities relates to the use of two distinct systems of water-works. One of these, very much smaller than the other, would provide the water necessary for drinking and similar purposes, while the second would furnish the very much larger quantity needed for fire extinction, manufacturing uses, street sprinkling, and similar purposes. The works for purifying the domestic supply, and for distributing it, could be constructed at very small cost if they were independent of those employed in furnishing water for other purposes.

REGISTER OF PATENTS.

Incandescent Gas Lighting and Heating Arrangements.—Ferron, C. A., of Paris. No. 16,571; July 29, 1898.

This invention "applies equally to incandescent burners for lighting and to burners employed for purposes of heating, especially in connection with kitchen stoves and box-irons." It consists in adding to, or mixing with, the mixture of air and gas formed at the mouth of a bunsen conduit, or simply adding to, or mixing with, the gas supplied by the ordinary supply system, air previously compressed, and compressed preferably at a pressure perceptibly equal to that of the mixture of air and gas, or to that of the gas alone; the compressing apparatus being "a hydraulic compressing and winding ventilator," with a reservoir for storing and regulating the pressure of the air.

Fig. 1 is a vertical section of a hydraulic compressing and winding ventilator, the working of which is assured by the falling of a weight to be wound up (as soon as it has reached the lowest extremity of its course), without the lighting or heating being affected by the stoppage of the compressor during re-winding. Fig. 2 is a vertical section of the



apparatus which is the complement of the compressor, and serves at the same time as a reservoir for the compressed air and to regulate its pressure and discharge. Fig. 3 is a vertical section of an incandescent burner furnished at foot with a bunsen-tube arrangement, to which the patentee's "improved means or process" is applied.

The patentee proposes to introduce in the passage of the central conduit C of the burner (fig. 3) a mixture-chamber D, in the centre of which is a pipe E (an "abductor" of the compressed air), surmounted by an additional piece F perforated with a central hole and at the base of a conical trunk extension G, which joins the upper part of the chamber D with the upper part of the central conduit C. A cock H circulates in the part E F the compressed air conveyed through the pipe I of the compressing apparatus; while another cock H^1 circulates the gas in the bunsen A. The degree of compression of this air is regulated by the weight P (fig. 1), and by the weight of the bell Q (fig. 2), equilibriated to a certain degree by the central spring, in order that the pressure may always be perceptibly equal to the pressure either of the mixture or of the gas alone, at the moment and place of contact.

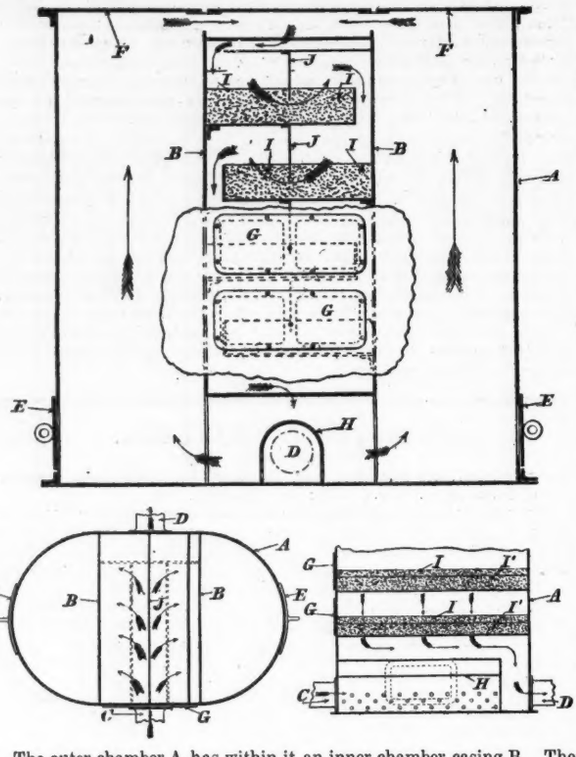
The air is introduced into the upper part of the compressor T (fig. 1) by the pipe K. Thence it penetrates into the "fly," which, in rotating, carries it along until the opposite aperture opens into the left-hand part, then separated from the right-hand compartment by the body of water. The air drawn in and compressed runs off under the bell Q, and thence flows to the mixing-chambers D (fig. 3). The "perfect mixture" between the gas and air corresponds approximately to 5½ of air and 1 of gas.

Scrubbing and Filtering Gas.—Willis, W. G., of Bristol. No. 16,868; Aug. 4, 1898.

This gas scrubbing or purifying apparatus consists of an outer casing, having apertures for the passage of gas to the interior; an inner casing carrying sliding trays, dividing plates, or partitions, adapted to cause the gas to pass through suitable filtering material in the trays; and an

inlet and outlet pipe so arranged that the gas passes through a packing of coke or other suitable substance, carried between the outer and inner case, and thence through the filtering material to the outlet.

The illustrations show a sectional side elevation and horizontal and vertical sections of the scrubber—the latter on a smaller scale.



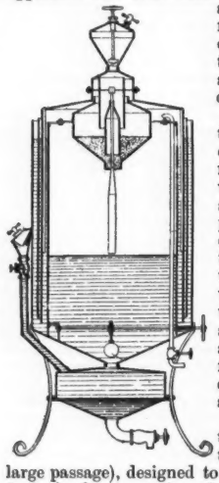
The outer chamber A has within it an inner chamber casing B. The outer chamber is packed with coke or like suitable material; and the gas enters at C. After passing through the coke, it enters the inner chamber or casing, which carries the trays or holders I, provided with suitable filtering material, such as sawdust. J is a plate so arranged as to enter the sawdust a sufficient distance to ensure the gas flowing through a layer of it. After having passed through the various layers of material, the gas reaches the exit-pipe D.

The trays I are so arranged that they may be withdrawn for recharging through suitable doors G; and the bottom doors E enable the coke to be withdrawn from the outer chamber when required. The top covers F of the outer chamber facilitate the recharging of the apparatus; while the perforated plate H is for spreading or distributing the gas.

By this invention, it is claimed to be "possible to clean or renew the filtering material without entering the apparatus or necessarily inhaling the gas or fumes therein."

Acetylene Generator.—Kremer, J., of Gilly, Belgium. No. 18,133; Aug. 23, 1898.

This invention relates to improvements on patent No. 26,776 of 1897; the objects being: To prevent the wedging or jamming of the regulating rod in passing through the carbide; to facilitate the maintenance of the apparatus in a clean condition; and to allow of the discharge of the mud and deposits during the working of the apparatus without necessitating a fresh supply of the whole of the water which may be contained therein—at the same time preventing any air entering the gasholder during this operation.

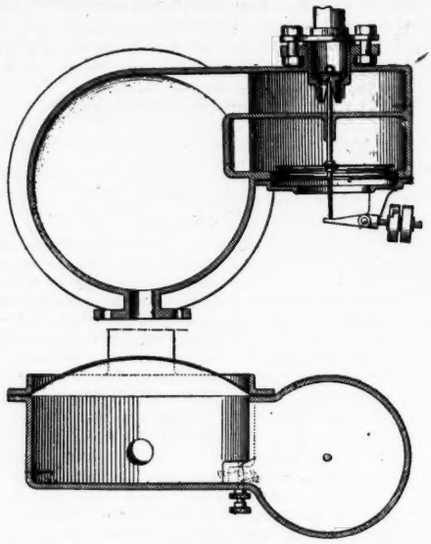


In the earlier apparatus, the carbide contained in the distributing hopper completely closed the passage for the regulating-rod, the result of which was that, when the rod moved with the gasholder, it met with a certain resistance occasioning slight jerks at a normal pressure of the gas. In order to remedy this objection, the patentee proposes (as shown in the engraving) to make a kind of passage for the rod through the mass of carbide, by providing it with an extension consisting of a very thin part reaching to the top of the gasholder, and in a great measure to free it from friction against the carbide by surrounding it with a fixed sheath designed to prevent contact of the carbide with the upward extension of the rod and the rod itself.

There is also arranged underneath the generator proper a small vessel (communicating with the generator by means of a cock having a large passage), designed to serve as a receptacle for the deposit resulting from the decomposition of the carbide. This vessel is of relatively small capacity; and when it is filled with deposit, communication with the generator proper can be cut off so that the water and the deposit in the vessel may be discharged, and the vessel filled with clean water before putting it again into communication with the generator, without in any way interrupting its working.

Regulating the Flow and Pressure of Gas.—Niel, A., of Paris. No. 18,345; Aug. 26, 1898.

This apparatus (as shown) is adapted for use in connection with gas-engines, or for other purposes where an even and automatic flow and pressure are desired.



The gas enters through a valve normally held open by a counter-weighted lever operating on the valve stem or spindle. The stem is also attached to a flexible diaphragm forming the bottom, or part of the bottom, of a chamber, from which a small opening is made into the main gas-chamber, with which it is otherwise not in connection. The size of the opening between the chambers is governed (say) by a conical-ended thumb-screw, and the counterweights operating upon the valve may be varied or adjusted as desired. The top of the main gas-chamber is also provided with a bellows or flexible top.

With this construction, the operation is as follows: The gas enters the main chamber, distends the flexible top, and also passes through the hole to the second chamber, where it depresses the flexible bottom, overcoming the action of the counterweights, and gradually closing the valve. If the gas or a portion of it is rapidly withdrawn from the main chamber, the flexible top would fall somewhat, and there would be a flow of gas through the hole from the second chamber and a gradual raising of the valve. The usual severe shocks, where gas is suddenly withdrawn, are thus obviated; and the time at which the valve re-opens can be regulated by the size of the opening between the chambers.

APPLICATIONS FOR LETTERS PATENT.

14,199.—Waché, A., and Locoge, E., "Effecting the flow of liquids with the object of heating or cooling same." July 10.

14,239.—Imray, O., "Manufacturing water gas." A communication from the Gesellschaft für Linde's Eismaschinen. July 10.

14,240.—Quelle, E., "Manufacture of acetylene gas." July 10.

14,261.—Boult, A. J., "Producing carbide of calcium." A communication from W. S Horry. July 11.

14,303.—Wall, W. H., "Apparatus for handling coal." July 11.

14,379.—Goodwin, R., "Purifying acetylene gas." July 12.

14,390.—Bower, G., "Mixing and burning gas and hydrocarbon vapours and air." July 12.

14,391.—Bower, G., "Volumetric gas or aeriform fluid governors, and their application as induction jets for incandescence burners." July 12.

14,401.—Weidlich, M., "Gaseliers and the like." July 12.

14,409.—Bültzingslöwen, B. von, Auw, A. von, and Montague, F., "Incandescent mantles." July 12.

14,413.—Butler, G. E., and Oakes, A. C., "Gas-stoves." July 12.

14,430.—Brooks, J. B., and Holt, J., "Gas and like engines." July 13.

14,444.—Fröhlich, B., "Automatically lighting gas." July 13.

14,499.—Söderberg, C. W., "Generating acetylene gas." July 13.

14,529.—Dowle, A. G., "Mantle-rod." July 14.

14,556.—Eldridge, F., "Burners for incandescent gas lighting." July 14.

14,575.—Simmance, J. F., and Abady, J., "Condensing apparatus for gas-works." July 15.

14,578.—Crossley, W. J., and Atkinson, J., "Internal combustion motors." July 15.

14,585.—Richardson, G. A., "Conveyors." July 15.

14,624.—Canova, P. A. P., Thompson, W., and Lorenzo, G., "Production of acetylene." July 15.

Extensions at the Rawmarsh Gas-Works.—Mr. R. H. Bicknell held an inquiry last Thursday at Rawmarsh relative to an application of the District Council for power to borrow £6800 for purposes of gas-works extensions. Mr. J. W. Bellamy, the Clerk, stated that the population was 15,500; the rateable value, £74,500; and the outstanding loans, £46,088. The consumption of gas had greatly increased owing to the growth of the population, and the extensions proposed might be adequate for seven or eight years. During the inquiry, the Inspector complained that the work for which the money was required had been done previous to the holding of the inquiry; and he said if this were allowed, such investigations would be a farce. He warned the Council that, if anything of the kind occurred again, the Local Government Board would refuse to sanction a loan; and the result would be that the money would have to come out of current rates.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Naphthalene Question.

SIR,—Referring to the remarks on the researches of Dr. P. Eitner on the above subject in the last number of the "JOURNAL," while fully endorsing the approval there expressed of the method by which he has attacked the naphthalene difficulty, and, having no wish to detract from the merits of the scientific exposition of his researches, I feel that it is desirable, in fairness to myself and my colleagues, Mr. Samuel and Mr. Thomas Glover, in connection with this question, to draw attention to the following facts.

First, I may perhaps be allowed to make the general statement that, ever since M. Brémond enunciated the idea that the presence of water vapour in the gas was the cause of the troubles arising from naphthalene deposits, I have demonstrated, both in your pages and elsewhere, by a reference to the laws affecting vapour tensions and the solubility and solvent power of liquids, that water had nothing to do with the naphthalene difficulty. Dr. Eitner's researches confirm this view of the matter. Similarly, on various occasions, both in your pages and elsewhere, I have demonstrated, by a reference to the physical laws bearing upon the subject, and also by experimental evidence, that hydrocarbons having a high vapour tension have, while in the gaseous state, no solvent power for naphthalene, nor yet the power of holding naphthalene in diffusion through the gas—that they only act as solvents on assuming the liquid condition. Dr. Eitner's researches also confirm this view.

I have neither the time, nor would your space allow me, to particularize these occasions; but I may be allowed to refer to the researches and practical work more recently contributed by myself and my colleagues in regard to this matter, which anticipated the principles put forward by Dr. Eitner.

With regard to the formation of naphthalene, I beg to refer to a paper contributed by Mr. Thomas Glover and myself to the Gas Institute meeting in 1897,* and published in their "Transactions" for that year. At the bottom of p. 114 and top of p. 115, the following statement is made:—

It has further been found in practice, with the high temperatures employed, that the common varieties of bituminous gas coals, owing to their constitution and molecular structure, are cracked up in such a manner as to leave, so to speak, comparative gaps in the series of hydrocarbons usually found present in the products resulting from the carbonizing of the same coals at lower temperatures. The paraffin hydrocarbons, with the exception of the lower member CH_4, are practically absent; while the easily decomposed creosoles and the higher members of the olefine and benzol groups of hydrocarbons (which have boiling-points and vapour tensions approximating to those of naphthalene, and which abundantly accompany naphthalene in the lower temperature products) are present in comparatively small quantities. The e appear to be cracked up by the higher temperature heat, and their constituents re-arranged to form the highly stable hydrocarbons, benzol and naphthalene, which stand out prominently among these products.

It is there clearly shown that we were aware that the naphthalene is produced by the action of the high temperature heat cracking up the higher members of the olefine and benzol group of hydrocarbons, xylene, &c., which in the low temperature products act as solvents of the naphthalene; and in the following paragraph on p. 115, the reasons are clearly stated for the presence of the naphthalene in the condensed gas, and for its subsequent deposition during distribution in the presence of benzol vapours:—

The altered constitution of the products from such coals, when carbonized at high temperatures, renders it exceedingly difficult to carry out the modern principles of fractional condensation by removing the condensed products from the presence of the gas as they are precipitated. For when the conditions during condensation become such as to lead to the precipitation of the naphthalene, this not being accompanied by a sufficient proportion of liquid hydrocarbons having approximately similar condensing points of vapour tensions, and which can take it up in solution, is necessarily precipitated in a more or less solid form, and causes stoppages. The gas is also left saturated with naphthalene, and, in many cases, even with naphthalene held in mechanical suspension in an extremely fine state of division, gives no end of trouble in the subsequent distribution, due to causes substantially similar to those which produce the trouble in the manufacturing plant—namely, the excessive quantity of naphthalene present in the gas unaccompanied by hydrocarbon vapours which have tensions similar to those of naphthalene; for, owing to naphthalene, on its assuming the solid form, having no solvent affinity for vapours whose tensions are much greater than its own, the presence of benzol vapours does not prevent the naphthalene being deposited in the solid state.

Then at the bottom of p. 119 and top of p. 120 there is the following statement, which shows that we were perfectly aware of the reasons why the modern system of carburetting fails to prevent naphthalene deposits:—

As has been already explained, the modern system of enriching coal gas by volatile hydrocarbons fails to prevent naphthalene deposits owing to the vapour tension of these hydrocarbons being so much higher than that of naphthalene, that the naphthalene begins to condense out of the gas, in the crystalline solid form, long before the tension of the carburetting vapours is so far reduced as to cause them to assume the liquid condition, and thus to enable them to act as a solvent.

The naphthalene may thus be largely deposited as a solid in one part of the distributing plant, and the carburetting vapours subsequently deposited as a liquid in a more distant part, on the gas being subjected to still lower temperatures.

Then, again, at the bottom of p. 120 is given the reasoned-out remedy, consisting in—

Carburetting the naphthalene charged gas with the vapours of a hydrocarbon fluid having vapour tensions approximating to that of the naphthalene, so that when the naphthalene was precipitated from the gas, it would be accompanied by a sufficient quantity of liquid hydrocarbon to keep the naphthalene from being deposited in the solid form.

The principle of the process is again given more fully at the bottom of p. 125, where it is stated as follows:—

Where the conditions connected with a works are such that neither of the methods which have been just described for dealing with the difficulties arising from the naphthalene deposits can be adopted, a modified carburetting process will be found greatly to reduce, if not completely to remove, those difficulties; for, as already explained, crystalline solid naphthalene deposits only take place from gas when the naphthalene vapours are present in the gas unaccompanied by the vapours of liquid hydrocarbons having similar vapour tensions. It is therefore evident that, by carburetting naphthalene-charged gas with the vapours of liquid hydrocarbons having similar vapour tensions, whenever the conditions become such as to cause the precipitation of the naphthalene from the gas, the vapour of the liquid hydrocarbon will be simultaneously condensed, and will take up the naphthalene in solution.

It now only remains to make a short reference to the process in operation at St. Helens, and that only in so far as it has a direct bearing upon the anticipation of the practical application of Dr. Eitner's researches.

We have already seen that the main difference relating to the naphthalene question between the products from the carbonizing of coal at a low temperature compared with those got at high temperatures, is that they contain a larger quantity of the higher members of the olefine and benzol groups having vapour tensions approaching those of naphthalene. These would be largely composed of xylene and other hydrocarbons having a high solvent power for naphthalene, and approximately similar vapour tensions. The process in operation at St. Helens, therefore, consisting of pouring into the condensed gas from the high temperature carbonization, the hot products of a portion of coal carbonized at a lower temperature, comprises, as one of its functions along with others, the carburetting of the naphthalene-charged gas with hydrocarbons rich in xylene directly produced from the carbonizing of a portion of the gas-making coal at suitably lower temperatures.

The xylene or similar hydrocarbon having the desired character may, however, be derived from any convenient source, as shown by the following passage from the specification of the patent granted to my colleagues and myself, dated Sept. 11, 1896:—

The liquid hydrocarbons suitable for such a purpose are the portions of the distillates of coal tars, blast-furnace tars, paraffin, and some varieties of petroleum oils whose solvent power for naphthalene is considerable, and whose vapour tension approaches that of naphthalene; and they are volatilized into the naphthalene-charged gas in any convenient carburetting arrangement in which the temperature and the quantity admitted can be so regulated as to cause the volatilization of the requisite quantity of such volatile hydrocarbon to produce the desired result.

But whatever may be the source from which the hydrocarbons may be obtained, the principle remains the same; and, so far as I have been able to learn, my colleagues and myself were the first to advocate, as one of the remedies for naphthalene deposits, the use of such low-tension hydrocarbons to carburet the gas, with the direct object that they should condense out, and act as a solvent for the naphthalene, whenever the conditions to which the gas was subjected were such as to cause it to be precipitated.

Priorsford, Peebles, July 21, 1899. W. YOUNG.

* See "JOURNAL," Vol. LXX., p. 16.

Experience with the Hydraulic Main.

SIR,—The retreat of Mr. Carpenter is somewhat lacking in dignity, and seems to indicate a want of self-confidence which is more especially marked in one who has entered the field in order to champion the cause of another. It is also lacking in courtesy to myself, as there was an error to be acknowledged; but probably the press of business in taking up his new duties has prevented his remembering that. There is mention for the first time of a water-seal and of tar that is deficient in benzol. These are matters of such importance that I, and, I believe, many others, would like Mr. Carpenter to speak more fully upon them. We should be grateful to him if he would give us details and particulars of the same before he finally settles down to the retirement and seclusion of the Old Kent Road.

Stalybridge, July 21, 1899. W. CARR.

The Reported Explosion at the Beckton Chemical Works.

SIR,—I shall be glad if you will kindly contradict the account you gave in last week's "JOURNAL" of an explosion and serious injury to two men, said to have taken place at these works on the 13th inst. There is not the slightest foundation for the story; and nothing has occurred which could in any way give rise to it. On inquiries being made at the Seamen's Hospital, to which the men were said to have been removed, I was informed that they knew nothing of any accident, and that it was evidently a hoax.

Beckton Products Works, July 22, 1899. T. WILTON, Manager.

[We were not alone in publishing the account to which our correspondent refers. A similar paragraph appeared in several other London papers.—ED. J.G.L.]

The Honley Gasholder Explosion.

SIR,—Reading the report of the Coroner's investigation into the above in your last issue, I was surprised to find that Mr. Porter, of Elland, thinks it *remarkable* how the holder was lifted up into the air. He says the explosion was not of a "tear-away" and general "bust-up" sort, but "an expansion of the gases." It would be useful for many of us to know the views of an authority on the subject. Under ordinary circumstances—that is, when the crown of a gasholder is filled with an explosive mixture—if fired from the top, as in the Honley accident, the expansion of the gases would certainly tend to blow up the holder, and not burst it. I have tried this experiment several times with small holders filled with acetylene and air, and there has been a blow-up and never a burst.

If it had been a purifier or a scrubber, I should have agreed with Mr. Porter in saying the accident was remarkable. These are more or less hermetically closed chambers, and any explosion within would act as an ordinary bomb; but in the event of an explosion in a gasholder free to run in its guides, unless jammed during the ascension, it seems to me it must behave just as the one at Honley did. What, to my poor knowledge, seems remarkable, is the admission of Messrs. Dempster's foreman plater, that neither he nor the men under him "knew anything about the properties of gas."

34, Victoria Street, S.W., July 19, 1899. P. INFANTE.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bill reported: Menstone Water Bill.

Bills reported with amendments: Belfast Corporation Bill, Bootle Corporation Bill, Darwen Corporation Bill, Godalming Corporation Water Bill, Warrington Corporation Bill.

Bills read the third time and passed: Blackpool Improvement Bill, Manchester Corporation (General Powers) Bill, Redditch Gas Bill, Stockport Corporation Water Bill, Walker and Wallsend Union Gas (Electric Lighting) Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bill read a second time and committed: Gas Orders Confirmation Bill (No. 2).

Lords Bills reported, with amendments: Fylde Water Board Bill, Great Yarmouth Water Bill, Leigh-on-Sea Urban District Council Bill, Salford Corporation Bill, Wakefield Corporation Bill.

Lords Bills read the third time and passed: Gas Orders Confirmation Bill (No. 1), Gas and Water Orders Confirmation Bill, Water Orders Confirmation Bill, South Hants Water Bill.

HOUSE OF COMMONS COMMITTEE.

Thursday, July 13.

(*Before Sir* W. Houldsworth, *Chairman*, *Mr.* Thomas, *Mr.* Lucas Shadwell, *and Mr.* Macdona.)

YEADON AND GUISELEY GAS BILL.

This Bill, which has already been passed by a Committee of the House of Lords (see "Journal" for March 21 last, p. 730), came up for consideration before the above-named Committee to-day. Its object is to substitute for the maximum price of gas chargeable by the Yeadon and Guiseley Gaslight and Coke Company a standard price, with a sliding-scale of dividends. The Bill also includes a clause empowering the Company to undertake the supply of electricity.

Mr. Balfour Browne, Q.C., Mr. Freeman, Q.C., and Mr. Shaw appeared for the promoters; the Hon. J. D. Fitzgerald, Q.C., and Mr. Wedderburn, Q.C., represented the Urban District Councils of Yeadon, Guiseley, and Rawdon who petition against the Bill.

Mr. Balfour Browne, in opening the case for the promoters, said the object of the Bill was to put the Company in a position in which they ought to have been put in 1880, when, owing to a mistake of the then agent for the Company, the provision for the sliding-scale was left out of the notice for the Bill of that year. As a consequence of the mistake, the power to raise £30,000 of new capital then obtained had never been exercised. In modern times, consumers of gas were protected differently from the manner in which they formerly were. In old days, Parliament fixed a minimum price which was not to be exceeded; while it further protected consumers by providing that when the Company had divided the maximum statutory dividend, and had their reserve full, they should be bound to reduce the price of gas to the consumer. It was always competent for any two or more consumers in the district to take the Company before the Magistrates, and force them to reduce the price. Modern legislators, however, had thought it better to give the Company themselves an inducement to reduce the price of gas, whenever they had earned a certain amount of money. Therefore the protection now inserted in all Acts of Parliament was, first, that the Company should sell their shares by auction, and if there was a premium realized it should go into the capital of the Company, and bear no dividend; and also that, instead of the maximum price, there should be a standard price. If, by economy of management, the Company were able to work in such a way as to charge a lower rate than the standard price, they were able to divide a larger dividend than the one fixed in the Act. On the other hand, if, owing to bad management, a higher price was charged than the standard, the shareholders would have to submit to a lower dividend. Counsel then detailed the history of the concern as placed before the Committee of the other House, and said that the Company supplied the three separate districts of Yeadon, Guiseley, and Rawdon, besides the township of Menstone. These three Councils appeared separately in the other House against the Bill; but they were now joint petitioners. The whole desire of the Urban Councils was to get a very low standard price. He, however, hoped to convince the Committee that in this particular case the figure fixed by the Committee of the House of Lords, on the representations of the Councils, was really two low. The Company had asked for a standard price of 3s. 6d. If they could have reduced the 3s. 6d. to 3s. 2d., it would have enabled the Company to divide an additional 1 per cent.; if, on the other hand, the price was increased from 3s. 6d. to 3s. 10d., the shareholders would have had to accept 1 per cent. less. The House of Lords had fixed 3s. as the standard price. If the Bill were accepted by the Company, they would have to face the difficulty of the standard price being too low; and it was really a question whether it was worth their while to take the Bill. The reduction of the standard price would within a very short time involve a reduction in the dividends. There had, since the Bill was in the other House, been negotiations; but no agreement was arrived at. When the three Local Authorities appeared before the House of Lords Committee, their points of objection were that the standard price was too high, and that the Company were asking for power, with the consent of the Board of Trade, to promote a Provisional Order for the supply of electricity.

In reply to Mr. Thomas, Counsel said that, as a matter of fact, the Lords Committee gave the Company 3s. as the standard price, and reduced the increase that the Company might give on the 7 per cent. stock—perfectly logically—from 5s. to 3s. 6d; 5s. being the amount the Company might increase their dividend by in respect of 1d. reduction.

Continuing, Mr. Balfour Browne said the further objections now taken by the petitioners were as to the standard price, the absence of a limit to the reserve fund, and the electric lighting clause. They also contended that an illuminating power of 14 candles for the gas was too low. In addition, they wanted another testing-station in the district, and asked for a purchase clause. While admitting that a purchase clause had been introduced in a great number of cases where non-statutory companies had come to alter their position, as against the consumers of gas or the local authorities, he did not know of one instance where a clause for purchase had been introduced into the Bill of a statutory company without their consent. The one case that seemed to go near to upsetting the practice, was that of Redhill and Reigate. But that was an amalgamation of a statutory Company with a non-statutory Company; and, upon Lord Lauderdale's Committee indicating their intention of putting a purchase clause in the Bill, it was withdrawn. The present price charged by the Company was 3s. 6½d.; but there was a discount of 10d. for prompt payment, so that the net cost was 2s. 8½d. In Menstone, however, which was a long way from the Company's works, the charge was 3s. 1½d. At first sight, it might seem that the Company were in a position to supply gas at 2s. 8½d., and that, with 3s. as the standard they would be at once able, by reducing the price to 2s. 8½d., to pay a larger dividend. No doubt it would be contended that this was the chief reason of the Company coming to Parliament. The main object was to get a chance, by means of economy, of distributing a larger dividend; but with 3s. as the standard, there would be no margin, and there was almost the certainty of the Company having to increase the price or reduce their dividends. In all these matters, the chief factor was the price of coal. At the present time the Company were working under very favourable contracts; but these were coming to an end, and they would have to face a rise of 1s. 6d. per ton. This would cause a further expenditure of £600, and would involve the necessity of increasing the price of gas by 2d. per 1000 cubic feet—or to 2s. 10½d. Beyond the absolute certainty of the rise in coal, the Company would lose a further £80 by charging in Menstone the same price as in the other districts—making altogether a difference in working expenses of £680. Having detailed the capital expenditure in contemplation, Counsel said that almost in the immediate future the net price of gas would have to be throughout the whole district 3s. 1½d. Under the reduction of the standard price imposed by the Lords Committee, the Company would, supposing they increased the price of gas by 1d., lose upon the 10 per cent. shares 5s. per cent., and upon the 7 per cent. shares 3s. 6d. instead of 5s. The result would be that the £30,000 of new capital would realize a very small premium, and so the consumers would suffer in there being a larger proportion of dividend-bearing capital in the Company.

Mr. Edward Lister, the Secretary and Manager of the Company, was the first witness called. He gave evidence bearing out the opening statement of Counsel as to the history of the Company. He thought 3s. 6d. was a fair standard price. Both the Otley and North Bierley Gas Companies had a 3s. 6d. standard; their capitals being much larger than that of the Yeadon Company.

By the Chairman: One reason why the Directors had not issued any portion of the £30,000 authorized, was because they objected to raise capital under the auction clauses without having the advantage of the sliding-scale. It was always their intention to apply for the sliding-scale before issuing the capital.

In cross-examination by Mr. Wedderburn, witness said that it was not the desire of the Directors to pay a higher dividend without reducing the price of gas to the consumer. He considered the Bill incomplete without the auction clauses; but he did not know that there were in Yorkshire alone fifteen Gas Acts containing the auction clauses but no mention of the sliding-scale. The omission of the sliding-scale in the Company's 1880 Act was an oversight. Witness was further cross-examined to show that the accounts had not been kept as required by law, and that the Company had borrowed £4050 illegally, He denied the illegality of this act. On Counsel seeking to prove that the Company had put more than their statutory limit of 10 per cent. of the nominal capital to reserve,

Mr. Freeman objected, and pointed out that Committees of Parliament were not in the habit of deciding elaborate legal questions.

Mr. Wedderburn said he wished to show the Committee that for years the Company had carried to funds not contemplated by their Act large sums which should have gone to the consumers in the reduction of the price of gas; and that therefore, if they had been able to supply at 2s. 8½d. and yet put large sums into their pockets, they had been appropriating money which should have gone to cheapen the price of gas.

In re-examination by Mr. Freeman, witness said that, though not, technically speaking, in the form prescribed by the Act, the accounts showed all the information which the Act required.

Mr. Henry Woodall said that in accepting the auction clauses without the sliding-scale, the Company had given everything to the consumer, without receiving any powers worth fighting about. Previously, under the Gas-Works Clauses Act, the Company could have placed their shares at par among the shareholders, who would have been assured of 7 per cent. probably on all new capital. Witness put in figures showing that the price of coal in London had decreased from 20s. 9d. per ton in 1875 to 11s. in 1896, which was equal to a difference of 1s. per 1000 cubic feet of gas sold. The reverse of this fact would cause a considerable fall in any company's stock. Since 1896, the price of coal had been rising, and contracts were now being made at Yeadon at 1s. 6d. per ton increase upon last year's prices. He therefore thought it would be most unreasonable to subject the Company, under the present circumstances, to conditions which had been enforced by the opposite circumstances. There was no reason, in his view, why colliery proprietors should not run up prices as they did between 1873 and 1876. He had found that, out of 174 companies subject to the sliding-scale, only 6 had as low a standard as 3s.; and in every one of these cases there was something exceptional. He considered that to increase the candle power beyond 14, in these days of improved burners, was simply a waste of good money.

In cross-examination by Mr. Fitzgerald, witness said that, in unluckily failing to secure their chief object in coming to Parliament in 1880, the Company had no incentive to increase their business or raise additional capital. He admitted that, whereas at present all the extra profits went

to the consumer, the shareholders now desired part of them. There was, however, nothing more nor less in the position now than when the Company came to Parliament in 1880, when they would undoubtedly have obtained the sliding-scale with a maximum of 5s., instead of 3s.

Friday, July 14.

Mr. Henry Woodall, in re-examination by Mr. Shaw, submitted a list of companies having margins of from 6d. to 11d. between the prices actually charged and the standard prices fixed in their Acts. In his opinion, the undertaking had been worked very economically. The Corporations of Stockton and Darlington had, he said, already raised the price of gas by 3d. per 1000 cubic feet over last year, owing to the increased cost of coal.

Mr. Thomas Newbigging gave evidence as to the anticipated expenditure on capital account, and corroborated the previous witness as to the increased cost of coal. He said that from an analysis of the accounts, it appeared that, in order to pay the statutory dividends, the Company would have to calculate on a charge of 39·14d. per 1000 cubic feet. He thought they should have a margin of at least 3d. above this.

In reply to the Chairman, witness said that the cost of raising the illuminating power from 15 to 16 candles would be proportionately greater than the cost of raising it from 14 to 15 candles.

In cross-examination by Mr. Fitzgerald, witness said he doubted the accuracy of the statement, based on the returns to the Board of Trade, that the Company were now supplying gas of 17¼-candle power, as tested by the "London" burner. There was no reliance to be placed on Board of Trade returns. There must always be a margin of 1 to 1½ candles, in order to avoid trouble. He did not think it wise to multiply testing-stations, because it was a further tax on the consumers. He thought it would be only reasonable for the Committee to raise the standard price to 3s. 6d.

Mr. A. E. Jenkinson, a Director of the Company, was also called in support of the Bill. In cross-examination by Mr. Fitzgerald, he said he was also a member of the Yeadon District Council, and was present when a resolution was passed approving the joint action of the three Local Authorities, with a view to the purchase of the works. The resolutions expressly provided for the wording of the petition to be such as not to make it compulsory on the Council to proceed with the purchase.

In re-examination, witness said that the Clerk to the Council told them their Parliamentary Agent recommended that the question of purchase should be made the subject of a resolution, in order to aid the Council in their opposition to the Bill.

This closed the case for the promoters.

Mr. E. H. Stevenson gave evidence as to the alleged illegality in the method of dealing with the accounts, and said that a company with a maximum dividend could sell their capital even to better advantage than a sliding-scale company. The accounts not being in the statutory form, made it difficult to ascertain what was actually spent on the different items, and had rendered it impossible for the consumers to appeal to Quarter Sessions. The standard should be fixed in relation to the actual price, having in view the fact of whether the price was a fair and reasonable one. He advocated the establishment of a separate testing-station, and disagreed with the evidence of Mr. Woodall and Mr. Newbigging that the quality of gas did not depreciate in going through the mains.

Cross-examined by Mr. Freeman, witness said the sliding-scale certainly ought not to produce economy in management, and he doubted if it did in these days, when there were so many illuminants competing with gas that everybody was compelled to do his best. In the early days of the sliding-scale, this was not the case.

In reply to the Chairman, witness said the tendency of the price of coal after a rise was to fall lower than the point at which the rise started; and he did not anticipate the present increase would last very long. He did not think the tendency in the next fifty years would be so very much towards a rise in coal, in view of the exhaustion of the coalfields, unless the general cost of living should rise.

Mr. Fitzgerald, in addressing the Committee against the Bill, said the Company had capital powers to carry them on for several years. They had spent from £250 to £300 a year on capital account which ought to have gone in reduction of the price of gas. The Bill was an entirely unprecedented one. It was simply and solely to enable the shareholders to get increased dividends. The first result of the passing of the Bill would be to enable the Company to divide 10¾ per cent. among their original shareholders, without any pretence of a benefit to the consumers. Experience had proved that sliding-scales had been fixed on too liberal a basis, enabling companies to distribute 10, 11 or 12 per cent., and even more. In view of the fact that the three Local Authorities concerned had passed resolutions in favour of promoting a Bill for the purchase of the undertaking, he asked the Committee to reject the Bill.

Without calling upon Counsel for the promoters to address them in reply, the Committee decided that the preamble had been proved. The Chairman said the Committee desired to make no alteration, except with regard to the illuminating power, which must be 15 candles, instead of 14.

Clauses were then gone through; and the Bill, as amended, was ordered to be reported to the House.

THE CONTEST FOR THE DERWENT WATERSHED.

The Derwent Valley Water Bill, which provides for the acquisition and administration of the water of the River Derwent and its tributaries by a Joint Board, upon which the Corporations of Derby, Leicester, Sheffield, and Nottingham, and the County Council of Derbyshire, will be represented, came on the 13th inst. before a Committee of the House of Lords, presided over by the Earl of Lauderdale; the other members being the Earl of Abingdon, the Earl of Mayo, Lord Llangattock, and Lord Monk Bretton.

The Bill, it will doubtless be remembered, is the outcome of the protracted proceedings before the Committee of the Lower House, to whom were referred the competing Bills of the three first-named Corporations.*

* See "JOURNAL," Vol. LXXIII., pp. 1434, 1496, 1575, 1672, 1766.

For the joint promoters there appeared Mr. Pope, Q.C., Mr. Pember, Q.C., Mr. Balfour Browne, Q.C., Mr. Worsley Taylor, Q.C., Mr. Claude Baggallay, Q.C., Mr. Moon, and Mr. Vesey Knox. The several petitioners were represented as follows: The Chesterfield Rural District Council, by Mr. Littler, C.B., Q.C., and Mr. A. G. Rickards, Q.C.; the Nottinghamshire County Council, by Mr. Erskine Pollock, Q.C., and Mr. Reader Harris, Q.C.; the Derbyshire County Council, by Mr. Macmorran, Q.C., and Mr. Rickards, Q.C.; the Leicestershire County Council, by Mr. Pembroke Stephens, Q.C., and Mr. Acworth. The right to retain Counsel was reserved in the case of the Duke of Norfolk, the Duke of Rutland, the Duke of Devonshire, and the Corporation of Rotherham; the petitions in the last two cases being directed against any alteration of the scheme sanctioned by the other House.

In opening the case, Mr. Pope characterized the Bill before their Lordships as one of the most interesting, and, as regards parliamentary procedure, one of the most important, which he recollected having been introduced to the other House. It was the result of a most careful investigation on the part of a Select Committee of that House, and of the consolidation of several Bills which had been introduced for the purpose of dealing with the Derwent watershed. The learned Counsel then gave a detailed account of the proceedings, which ultimately led to the result stated, and the formation of a Joint Board to carry out the objects of the Bill. The first question to be decided by the Committee of the other House was whether or not Sheffield should be admitted to a share of the waters of the Derwent; and they determined that she should. The present Bill was therefore promoted by a Joint Board of four on agreed propositions. The total quantity of water available daily was estimated at 33 million gallons. After the admission of Sheffield, the proportions allocated to each Authority were: To the Derby Corporation, 25 per cent. of the produce of the watershed; to the Leicester Corporation, 35 per cent.; to the Nottingham Corporation, 15 per cent.; and to the Sheffield Corporation, 25 per cent. Special provision was made for the supply of the Derbyshire County Council. The question to be decided by their Lordships was whether the Nottinghamshire and Leicestershire County Councils ought to be put into the Bill in the same position as the Derbyshire County Council. The provision which had been made for their supply was that which Parliament had adopted in similar cases where water was brought from a distance; the principle being that those who bore the expense of the works should be entitled to be supplied before others could have a claim. This plan was adopted with Manchester in the case of Thirlmere. The parties were agreed that the present proposal was the best way of dealing with the water area, and they came with a Bill to constitute a Joint Board, of which Sheffield, Nottingham, and Leicester would form constituent parts. This Board would control the expenditure upon the construction of the works; and the contribution of the constituent Authorities to the expenditure would be practically in proportion to the amount of water allocated to them. The Nottinghamshire and Leicestershire County Councils were not put into the Bill in the same position as the Derbyshire County Council, and they now would contend for a further recognition of their claims. Under the Bill, Leicester county would be provided for by the Leicester Corporation after their own population had been supplied with 25 gallons per head. A similar provision had been declined in the other House by Nottinghamshire. Both of these Authorities now asked to be restored to the position they were in before the admission of Sheffield; but they ought to be content with a clause such as was inserted in the Thirlmere case, by which localities within ten miles of the main could obtain a supply from waters which were surplus to the authority bearing the expense of the scheme. This precedent had been followed in the case of Birmingham, Liverpool, and other places. With regard to the Nottingham City Council, Counsel pointed out that now that the city supply would no longer be drawn from the Bunter beds, these would be available for the county. At present, Leicester was in urgent need of further water; and it would be disastrous if the scheme provided by the Bill were not at once carried out. Every regard had been paid to the needs of the counties of Leicester and Nottingham by the Committee of the other House, in their careful consideration of this matter; and he asked their Lordships to agree with the decisions of that Committee, and to allow the Bill to go forward in its present shape. In dealing with the various petitions, Counsel said the Nottinghamshire County Council alleged that Sheffield's share to the waters should be struck out, as the borough had no immediate need for them. But to do this would be to undo all that had been done in the matter. In reference to the petition of Chesterfield, the principal point that would have to be dealt with was with respect to the limit of supply being 12½ gallons per head of the population. Before the Committee of the other House, the Chesterfield Rural District Council claimed 15 gallons per head as a proper amount. The clause of the Bill was agreed to between the Counsel for the promoters and the Chesterfield Authorities. It was now said that the representative of the Chesterfield Council, when signing the agreement, did not notice that 12½ gallons had been fixed instead of 15. Therefore, he (Mr. Pope) did not think it would be fair to press this agreement, which must fall to the ground, and the question be again discussed.

Mr. Charles Hawksley, the Consulting Engineer to the Derby Corporation, then gave evidence in support of the Bill. He stated that the total quantity of water available from the watershed was 33 million gallons per day, of which Derby would take 7 millions, Leicester 10 millions, Nottingham 4 millions, and Sheffield 7 millions; 5 millions would also be taken by the county of Derby. Rotherham and the northern portion of the county of Derby, including the Chesterfield area, would have to be supplied out of Sheffield's proportion of the water. The cost of the works, including independent works, would be £6,645,000. Works would be first constructed for a yield of 11 million gallons a day. The position of Derby would have entitled it to more than 7 million gallons; but, owing to the great needs of other places, its proportion had to be limited to this amount. The supply to the county of Derby had also to be restricted in consequence of the Commons Committee's decision to admit Sheffield. With regard to the petition of Mr. Leslie, a land and mill owner, witness was of opinion that he would be adequately compensated, if the usual one-third were allotted to him.

At this point, Mr. Erskine Pollock, referring to the statement that the Nottinghamshire County Council had been offered the Leicester clause, under which a supply of water would be afforded to districts within 10 miles of the main, and had declined it, said it had not been accepted

because it would not meet the claims of the Council. He then proceeded to cross-examine Mr. Hawksley on his evidence. Witness, in reply, said that, in his opinion, the prior claim to the Derwent water rested with Derby town and county; then came Nottingham and Nottinghamshire; and, more remotely, Leicester and Leicestershire. Sheffield had no sort of claim whatever to it, being entirely outside the watershed. It was quite true that before the other Committee he said the Bunter beds, upon which Nottinghamshire largely depended for its supply, were being rapidly exhausted.

In answer to Mr. Rickards, witness said he thought the population of the rural district of Chesterfield who would need a supply of water should have 15 gallons per head per day; and Counsel said all he was asking was that the amount should be made up to this.

Mr. Acworth said he could substantially adopt the cross-examination of Mr. Erskine Pollock; but he should like to ask witness whether, taking the large figure of 30 gallons per head, Derby would in 1935 require the 7 million gallons, and a fraction, which was the yield of the Derwent watershed allocated. At that date they would have 3¼ million gallons a day of what was described as good, but fairly hard water which, if they chose, they could refuse to pump. Witness acknowledged that this was so. Counsel then said: "You will be using all Derwent water, and Leicestershire will be told that there is not a drop of Derwent water available for them, because Derby is so particular that it is prepared to allow to go to waste 3¼ million gallons of good, but fairly hard water." Witness said 1935 was not a long period to look forward to; nevertheless, it might be that before that time Derby would again be driven to use the hard water.

On the resumption of the proceedings next day, Mr. Charles Hawksley was re-examined by Mr. Worsley Taylor. He said the county of Nottingham had failed to substantiate the allegation that they were at the end of their tether as to the supply of water; and the Committee of the House of Commons were satisfied that they had sources from which they could serve themselves. It was expected that the supply of water reserved under the Bill for the county of Derby would be exhausted by the year 1921; and if the Corporation then felt that they had any water to spare, they would naturally desire to assist their own county rather than that of Nottingham. It was after the claim of Sheffield had been recognized by the Committee of the other House that the question of the supply available for Nottinghamshire was gone into. Up to that time, it was hoped that none of the water from the Derwent Valley would go to Sheffield. But the Committee determined otherwise; and this entirely altered the footing upon which various authorities were placed. The pipe running through Nottinghamshire would be very nearly 10 miles in length, and practically the whole of the southern portion of the county would come within the limit which it was proposed to supply from the pipe-line, and the remainder would have a good source of water in the Bunter beds, which stretched northwards to the borders of the county.

Mr. E. M. Eaton was the next witness. In answer to Mr. Baggallay, he said Sheffield was under parliamentary obligation to supply Rotherham, Doncaster, and intermediate places on the River Don, and the demand was now greater than the existing works could supply. The only available gathering-ground left to them was the valley of the Derwent. By the Bill, Sheffield would be bound to supply the districts named at the rate of 20 gallons per head per day in the urban areas, and 12½ gallons in the rural areas. Chesterfield and the Rother Valley would require in a very few years from 2 to 2½ million gallons per day from Sheffield. So far as he could estimate, in 30 years from now Sheffield would have to send outside her own limits quite half the water she was now seeking to obtain. South of Mansfield, the Bunter beds were in full use. Between Mansfield and the northern limit of the county of Nottingham the beds absorbed 40 million gallons of water per day, which was amply sufficient to meet the requirements of that portion of the county. He was not aware of any danger to the yield of the Bunter beds through the extension of mining operations. The water would either be prevented from entering the shafts by "tubbing," or if it did enter it would be pumped out again. There were water-bearing strata in Leicestershire, except in the centre area, sufficient to meet all requirements there.

In cross-examination by Mr. Littler, for the Chesterfield Rural District Council and the Chesterfield Gas and Water Board, witness admitted that the priority of the county of Derby over other outside authorities was practically conceded in the other House; but the arrangement as to the supply of 20 gallons per head per day in the case of the Gas and Water Board and 15 gallons per head per day in the case of the Rural District Council from the Corporation of Sheffield had been modified.

Mr. Moon (intervening) conceded that, by misapprehension on the part of Mr. Rickards, 12½ gallons, instead of 15 gallons, had been inserted in the clause as it appeared in the present Bill; and he expressed his willingness to allow the matter to be re-opened and discussed afresh, provided the question of the priority of Sheffield in the matter should also be re-discussed.

In further cross-examination, witness contended that 12½ gallons per head per day would be ample.

Mr. Reader Harris cross-examined witness for the Nottinghamshire County Council, with the object of showing the great need there was of water in the south-east portion of the county. He said that, although North Nottinghamshire had the water practically under their feet in the Bunter beds, this certainly was not the case with Rotherham, though it was so with Doncaster. Other portions of the cross-examination were directed to showing the effect of the pumping operations now going on in the neighbourhood of Worksop and elsewhere in drawing the water from the Bunter beds, and to supporting the claim of the Nottinghamshire County Council to be supplied from the Derwent in preference to districts which were not on the watershed, and to have the same terms conceded to them which had been given to the county of Derby. Having regard to the enormous demand for water for trade and other purposes in Sheffield, witness believed that the whole of their existing source of supply would be exhausted by the year 1920; and he had advised the Water Committee of the Sheffield Corporation that there must be no pause in the construction of their reservoirs.

Mr. Acworth cross-examined witness with the view of supporting a claim to preference in the matter of water supply for the county of Leicester over the manufacturers, even those who used water-tube boilers, which necessitated a purer supply than boilers of the old type.

Professor Boyd Dawkins gave geological evidence as to the probable yield of the Derwent Valley; and Mr. H. S. Childe, of Wakefield, stated that there was a large quantity of water pumped from the coal workings which the colliery proprietors would be glad to supply to the Local Authorities. Mr. W. B. Bryan, Chief Engineer to the East London Water Company, gave evidence as to the needs and sources of supply of Nottingham, and expressed the opinion that the offer to supply all parts of the county within the 10-mile radius, whether urban or rural, was a perfectly fair and reasonable one.

At the conclusion of this evidence, it was intimated by Mr. Balfour Browne that an arrangement had been come to with the Leicestershire County Council, under which the borough was at all times to be entitled to a priority supply of 25 gallons per day per head of the population from the existing sources.

Alderman Gainsford, Chairman of the Water Committee of the Sheffield Corporation, who was the next witness, said he expected the existing and authorized water supply of the borough would be exhausted in 1920; but with a growing demand for water for trade purposes, and the fact that, under the Bill, Sheffield would have to serve Rotherham and Chesterfield out of their existing supply, if called upon to do so, that date would be anticipated by four years, or even more than that. The existing and authorized supply and the supply under the Bill would, he estimated, be exhausted in 1934. The measure as it stood was a very fair and honest compromise.

The Committee then adjourned until the following Monday.

When the Committee re-assembled on the 17th inst., Alderman Gainsford was cross-examined by Mr. Erskine Pollock. He laid it down as an axiom in such cases as the one under consideration, that water arising within the area of the parliamentary supply of any local authority must be held to belong to them, except under very exceptional circumstances. This water did, as a matter of fact, arise in the area of the parliamentary supply of Sheffield; and that being so, it must be presumed to belong to that town. His contention was that the Corporations who were spending money on this scheme had the first right to the proceeds of it. Counsel remarked that, having regard to the permissive nature of the clause in the Bill, if Sheffield had more water than was required for her own consumption, there was nothing to prevent the Corporation selling the surplus to Rotherham or Doncaster, or anyone else in the district. And according to the evidence witness gave in 1896, the rights of Sheffield to this water depended upon those of the part of Nottinghamshire lying in the valley of the Trent. Witness said that part was almost entirely covered by the provisions already made in the Bill; but the northern portion was certainly not in any sense whatever in the watershed of the Derwent, and therefore had no claim to be supplied therefrom.

In cross-examination by Mr. Littler, witness admitted that, according to the original proposal under which Chesterfield was to be supplied by Sheffield and Derby jointly, Chesterfield was to have had 15 gallons per head per day. In the course of the negotiations, however, and having regard to the change of circumstances, he had come to the conclusion that 12½ gallons, without any limitations either as to time or the total quantity, would be ample for a rural district; and he was prepared to defend this contention on its merits.

The Chairman here intimated that the Committee fully understood this matter; whereupon Mr. Littler said he would leave it in their Lordships' hands, merely emphasizing the statement that it was a very serious question for the parties he represented. Alderman Gainsford said he was willing to reinstate the 15 gallons per head for Chesterfield conditionally on the previous clause being restored.

The next witness was Mr. William Terrey, the General Manager of the Sheffield Water-Works, who endorsed the evidence given by Alderman Gainsford. He said the average consumption of water per head for domestic and other purposes not by meter, including supplies for fires and waste, throughout the entire district of the Sheffield Corporation last year was 12·54 gallons. This represented an unrestricted and unlimited service, and included a large number of unmeasured trade supplies, baths, gardens, stables, fire supplies, flushing out mains, and a great variety of small class workshops and warehouses. It was therefore obvious that, if the supply was properly controlled, 12½ gallons per head per day was ample for the rural population surrounding Chesterfield, which could not possibly embrace the variety of supply covered by the 12·54 gallons, and which was found sufficient for the Sheffield district. The 12½ gallons per head per day proposed to be given to the Chesterfield rural district was a more liberal provision than the Bill made for the rest of the county. The county had a limited supply of 5 million gallons, *plus* the existing resources, which, according to Mr. Hawksley, it was estimated would be exhausted in 1921, and provided 15 gallons per head per day to 75 per cent. of the population. This was equal to 11¼ gallons per day per head of the entire population, and was terminable in 1921, when fresh sources would have to be provided. On the other hand, Chesterfield had a first charge upon the total resources of the Sheffield Corporation to the extent of 12½ gallons per head per day in perpetuity, and whatever the population may be. To sum up, although the precise unit of consumption might vary in the particular district or part of the district, experience clearly showed that 12½ gallons were ample and abundant for all domestic and other purposes such as could conceivably obtain over a rural area.

Mr. J. B. Everard, of Leicester, said the wants of the town in regard to water were exceedingly urgent. The present supply was 4½ million gallons daily; but they were using slightly more than this. He thought 10 million gallons a day was the minimum quantity that could make it worth while for Leicester to go such a long distance as the Derwent Valley for water. If the present supply were abandoned, there would only be sufficient water from the Derwent to last Leicester until 1922; but if it were not abandoned, they would have enough to last them until 1940. As to the northern part of the county of Nottingham, he agreed with the other witnesses for the promoters that sufficient water could be taken from the Bunter beds situated in that district for the supply of the inhabitants there. The southern part could be supplied under the Bill. In his opinion, one-third compensation would be ample for the mills affected by the Bill.

Mr. George F. Deacon corroborated the last witness with regard to the amount of compensation water which millowners would get under the scheme. He thought the future population of Leicester would be very much greater than had been estimated by some of the previous witnesses.

In his opinion, 12½ gallons per head per day would suffice for the Chesterfield rural district.

This concluded the promoters' case, and the Committee proceeded to hear the opposition of the Nottinghamshire County Council.

The first witness called was Mr. W. H. Radford, of Nottingham, who stated that there was nothing like the quantity of water in the northern part of the county that had been represented by the other side; while the water in the south was subject to contamination. They anticipated a large increase of population in the colliery districts. Mr. C. T. Wright, Chairman of the Health and Sanitary Committee of the County Council, endorsed the evidence given by the previous witness. He said he regarded the position of the county as extremely precarious, in having to depend on underground sources of supply. There was no question that the effect of the sinking of the coal pits, now in contemplation, and some of them in the western part of the county already begun, might deplete the existing supplies, and make it necessary to go to some other source for water. The coal which it was intended to work was situated below the Bunter beds. The borough of Leicester would, under the Bill, get something like 42 gallons per head of the present population, while Nottinghamshire was to get nothing. He considered that the people of Nottinghamshire, as being in the valley of the Derwent, held a prior claim on its waters to the people of Sheffield. In cross-examination by Mr. Balfour Browne, witness acknowledged that the Council wished the promoters to reserve 2 million gallons of water for any length of time it might be required by Nottinghamshire; but they were not going to find the capital for bringing this quantity of water into the county, as they had no power to raise money for such a purpose. Counsel then asked witness if he thought the ratepayers of Derby, Sheffield, and Leicester should become responsible for the capital charge for the 2 million gallons of water which Nottinghamshire might require ten, twenty, or fifty years hence, or not at all. He replied that if they chose to be so grasping as to take away the water from the watershed, they ought to give the county what it required. Mr. Balfour Browne said he thought the "grasping" was on the other side. Nottinghamshire wanted to grasp 2 million gallons of water and not pay for it. He asked witness if the County Council thought they could themselves fetch the water from the upper valley of the Derwent. Witness replied that he did not say they could. Lord Belper, the Chairman of the County Council, said the Council had supported the Derby Bill in the other House on the understanding that they obtained what water they wanted, and that if a Joint Bill were agreed to, similar provision should be made in it. The quantity Nottinghamshire was to have allocated to it was 2½ million gallons. When the agreement was come to between Derby, Leicester, and Sheffield, Nottinghamshire was left out. The contention of the County Council was that, next to Derby and Derbyshire, Nottinghamshire had the best claim to consideration in regard to the waters of the Derwent. If the whole of the water of the river was to be taken away and divided up, quite irrespective of what might be the immediate or even the future wants of the Corporations asking for it, some moderate portion, at all events, should be reserved for the county of Nottingham, in case the population needed it in the future. In the other House, they mentioned 2 million gallons as the quantity they ought to have; but they did not put this figure as the minimum. They did not want to adopt any "dog-in-the-manger" policy, and prevent other people having the water if the county did not require it; but the Council could not put themselves under any obligation to receive the quantity reserved for them.

The case for the Rural District Council of Chesterfield was then proceeded with. The first witness was Mr. John Middleton, Town Clerk of Chesterfield, and Solicitor to the District Council. He said the rural district comprised twenty parishes, in fourteen of which there were collieries actually at work. The population was entirely a working-class one. The Committee of the other House had decided that, whatever scheme was settled upon, Chesterfield was to have a supply of water from the Derwent. There had been nothing said about priority of supply being given to Sheffield before Chesterfield was served. Mr. Baggallay observed that at the period referred to it was arranged that there was to be a standing arbitrator to say how much water each party was to receive. Some further evidence having been given as to the conference and the agreement for the supply of Chesterfield, Mr. Baggallay said he wished to know the nature of the case he was expected to meet. Was it that the promoters had behaved badly, or was it whether Chesterfield was to have 12½ or 15 gallons of water per head per day? Mr. Littler said he was not going to allege misconduct against the promoters; but when the proposal as to Chesterfield was altered from 15 to 12½ gallons per day, his clients were not notified, and he wished to make a point of that. Mr. Baggallay said he was content to let the issue be whether the quantity of water should be 12½ or 15 gallons per head per day. Mr. Radford was then re-called, and expressed the opinion that the latter should be the quantity supplied to the Chesterfield district. Mr. Littler then addressed the Committee on behalf of the Council; and the proceedings were again adjourned.

The inquiry was resumed the next morning, when evidence was given on behalf of Mr. Leslie, the opposing millowner. Mr. Erskine Pollock then addressed the Committee on his behalf and that of the Nottinghamshire County Council. He claimed that the Council were riparian owners of the Derwent, because the stream flowed into the Trent. With regard to the necessities of the county, he drew attention to the fact that the population was increasing very rapidly, and that, owing to the multiplication of collieries in the county, surface wells were being depleted by the pumping operations. If Nottinghamshire were admitted to the scheme to the extent of 2 million gallons a day, it would only mean that the Derby supply would be exhausted in 1933 instead of 1935; Sheffield's supply in 1932, instead of 1934; and Leicester's in 1940, instead of 1942. It must be remembered that if the county were cut out now, it would be excluded for all time, because it was probable that powers in respect of the Edale and Burbage valleys would be sought in years to come, and then it would be said that Parliament in 1899 decided against Nottinghamshire, and therefore they were not entitled to the water now, or under any powers that might be sought in future. The quantity they asked for was based upon the 15 gallons per head in respect of the rural districts, and 20 gallons in respect of the urban areas.

Mr. Wedderburn said he should like to point out that Rotherham was petitioning against alterations in the Bill; and he objected to the claim of the Nottinghamshire County Council, because, if granted, it would reduce the share of his clients in the waters of the Derwent. Mr. Freeman, on behalf of the Duke of Devonshire, also objected to alterations.

Mr. Pope then briefly addressed the Committee on behalf of the promoters, in reply to the case of the petitioners. He said he would not discuss the mistake made with regard to the case of the Chesterfield rural district, as he desired to argue the matter on its merits. From his point of view, he submitted that the experience of other districts showed clearly that 12½ gallons per head were amply sufficient, and that therefore it would be found to be adequate for Chesterfield. He pointed out, furthermore, that Chesterfield was to get its supply in perpetuity, which placed it in a very much better position than the other rural districts under the Bill; the latter depending upon the Corporations first having a supply of 25 gallons per head. In regard to Mr. Leslie's case, the difficulty was that they had no facts to argue upon. If the Committee were satisfied with the evidence respecting Mr. Leslie's claim, he (Mr. Pope) should have no more to say; but he did not think they would be. As to the Nottinghamshire County Council, their case was not similar to that of Derbyshire, who had the Derwent running through their midst, and could utilize it at comparatively small cost. Nottinghamshire only got it in the Trent; and if it were not for Derby, Leicester, Nottingham, and Sheffield applying for the present Bill, they would not think of going so far afield for water. In the case of Manchester, Liverpool, and Birmingham, Parliament had decided that, save for the rights of those who spent the money to a reasonable equivalent for their expenditure, the surplus might be available to those who surrounded the main. The promoters were willing to adopt this plan to meet the case of the Nottinghamshire County Council, and the arrangement had been agreed to by Leicester. The proposal put forward by Nottinghamshire violated so much municipal finance that it was astonishing that a gentleman like Lord Belper should have given support to it. They demanded that 2 million gallons of water should be allocated to them, without having the expense of obtaining it, and without giving any guarantee that they would use it even if it were granted to them. With the assent of the Nottingham Corporation, he should be prepared to give them a clause similar to that agreed to by the Leicester County Council, which would render the Corporation liable to supply the area of the county within 10 miles of the aqueduct after the population of their own city had been supplied with 25 gallons per head from the existing and authorized sources.

At this point, the Chairman inquired of Mr. Freeman and Mr. Wedderburn whether they had anything to say on behalf of the petitioners against alterations; and these gentlemen said they were satisfied.

The Committee then deliberated in private. At the expiration of about a quarter-of-an-hour, the public were re-admitted, and the Chairman announced that the Committee had decided to allow the Bill to proceed, subject to a million gallons of water per day being allocated to Nottinghamshire, such quantity to come out of the shares of the four Corporations of Derby, Leicester, Sheffield, and Nottingham, *pro rata*. The shares of the Corporations amounted to 28 million gallons; the remaining 5 million gallons being the share of the county of Derby, which would mean that the Corporations would forfeit 1-28th of their quantity. The share of the county of Nottingham would terminate in 1930, because at that time all the parties would have to come to Parliament again. With regard to the Chesterfield rural district, the 12½ gallons per head would remain; and in the case of the petitioning millowner, an arbitration clause for his protection would have to be inserted in the Bill.

The proceedings were then adjourned till the following day, when clauses embodying the decision of the Committee were submitted.

The first point raised was in connection with the protection to be afforded to Mr. Leslie, which was to be subject to arbitration. Mr. Erskine Pollock pointed out that, as the Bill stood, there was nothing to compel the referees to make any return to the Joint Board till the end of six years. He therefore suggested the insertion at the end of clause 51 of words providing that they should, at the end of each year, furnish to the Board full and accurate returns of the rainfall. Mr. Baggallay said clause 51 simply provided that, in order that the amount of compensation water sent down should be ascertained, two persons should be appointed referees, and that they should keep rain-gauges. They were not under obligation to furnish rain-gauges to anybody. The Chairman asked Counsel if his point was that the referees should not furnish the information year by year; and he replied that it was—that they should not furnish it to the promoters or to anybody else. The Chairman said the Committee, on the contrary, thought they should; so that this point was settled. Mr. Baggallay promised that the clause should be altered in accordance with the Committee's decision.

Mr. Erskine Pollock said there was one other matter to which he had to refer. The County Council of Nottinghamshire interpreted the Committee's decision with regard to a supply of water to the county as meaning that, if they had not taken a supply from the Joint Board amounting to the whole of the million gallons allocated, by the end of the year 1930, they were not in future to have more than they had actually taken. The other interpretation was that at the end of the year named they were to cease altogether to have the million gallons. In other words, were they to be then compelled to give up the million gallons for ever? The Chairman said that was the Committee's decision.

Mr. Rickards next raised a point on behalf of the Chesterfield Rural District Council. He said the Committee would remember that Mr. Pope, referring to the Chesterfield case, said that the Rural District Council would be entitled to 12½ gallons per head of the population within their district. He did not wish the Committee to alter the 12½ gallons, but to omit from the clause the words "actually supplied or entitled to be supplied," and to insert "for the time being within the district of the said Council." The effect of this would be to give the Council more water, which they urgently wanted, as it would enable them to obtain 12½ gallons per day per head of the whole population of the district. Mr. Baggallay remarked that in many places there were already local supplies of such a character that no fresh water would be needed. Of course, if the proposal were adopted, and only half the population were actually supplied, the result would be to give those who were taking the water not 12½ but 25 gallons per head per day. The Chairman said the Committee were in favour of Mr. Rickards's proposal; and the clause was altered accordingly.

The non-contentious clauses were then passed.

On the clause providing that, if one or more of the four Corporations shall

not use the water allocated to each respectively, the surplus shall be offered to such of the Corporations as may require it. Mr. Erskine Pollock asked that the Nottinghamshire County Council should be one of the Authorities to whom the surplus should be offered. On behalf of the promoters, it was pointed out that the Derbyshire County Council did not possess this power, and if the Committee acceded to their request it would upset the terms of the arrangement between the four Corporations. After deliberating, the Chairman said the Committee had decided to refuse the application.

Mr. Erskine Pollock next asked that the Nottinghamshire County Council should have the power to form a junction with the aqueduct of the Nottingham Corporation. Mr. Pember objected, on the ground that if this were granted the County Council might seek to come into the city of Nottingham, and break up the streets for the purpose of forming the junction with the aqueduct. The Chairman intimated that, in the view of the Committee, the Council should have access to the pipe when constructed. Mr. Pember contended that, at any rate, they ought to pay to the Corporation a proportion of the cost of constructing the aqueduct. Mr. Erskine Pollock said the Council were prepared to pay their proper share. Subsequently a conference took place between the representatives of the parties, and an agreed clause was submitted to the Committee, and confirmed.

Some conversation then ensued as to the measures to be taken to deal with the report of the Local Government Board on the provisions of the Bill. Mr. Baggallay pointed out that the Board proposed an alteration of the arrangement which had been arrived at between the four promoting Corporations. The Chairman said he did not think the Committee could go into the matter at that stage. If the report had been submitted to them before, they might have sent for an official of the Board, and gone into the subject; but they could not do so now. Mr. Baggallay pointed out that the Committee had had the whole case before them; and if they considered the report it would mean that the Local Government Board, without having heard the evidence and without knowing what the circumstances were, would have a voice in deciding what had been gone into thoroughly. The Chairman remarked that the promoters proposed expenditure according to statutory arrangement; whereas the Board said it should be settled by an arbitrator in accordance with the amount of benefit derived. Mr. Baggallay acquiesced. The Chairman said that, in these circumstances, he did not think the Committee would disturb the arrangement already arrived at.

The inquiry then closed, and the Bill was ordered to be reported to the House.

LEGAL INTELLIGENCE.

Another Infringer of the Welsbach Patents Sent to Prison.

In the First Division of the Court of Session last Tuesday, Counsel were heard in a petition and complaint by the Welsbach Incandescent Gas-Light Company, Limited, against Richard Shepherd, of Brown Street, Dalmarnock Road, Glasgow. Interdict was obtained against the respondent infringing the complainers' patent, by selling mantles for incandescent gas lighting, in May, 1898. It was averred that the respondent had, notwithstanding the interdict, continued to deal in incandescent gas-mantles. The respondent denied infringement, and said that he was Manager in Scotland for the Incandescent Fittings Company, and that the mantles he sold were the "Daylight" or "Sunlight." Proof was led some time ago. The Court found that the respondent had been guilty of infringement. The Lord President said it was unnecessary, after all that had occurred in the trade with which the respondent had connected himself, that he should point out that any act of this kind was a very deliberate and intentional violation of the law as laid down by the Court. They had, on previous occasions, passed sentences of as much as two months' imprisonment; but as this seemed to have been insufficient to put down the practice, the sentence in this case would be three months.

The Dangers of Electric Light Boxes.

At the Brighton County Court last Friday, William Barnes, a gardener, of 2, Belfast Street, Hove, sought to recover £50 from the Brighton and Hove Gas Company for damages resulting from an explosion caused, as alleged, through the gas escaping from a defective main. Mr. F. T. Pearson appeared on behalf of plaintiff; Mr. W. P. G. Boxall represented the Company. Mr. Pearson said the explosion occurred on the south side of Church Road, Hove, on the 28th of January last. Plaintiff was passing from east to west, and when near an electric-light culvert the explosion took place. He sustained a severe shock, but was not otherwise hurt. He, however, had not recovered from it in the evening, and so he consulted Dr. Waring, who ordered him home, where he remained a month, and had ever since suffered more or less from nervousness. Mr. Boxall, for the defence, submitted that there was no evidence of negligence on the part of the Gas Company; and the breaking of a main did not give cause of action against them. The Electric Light Company had five boxes near; and, by the regulations of the Board of Trade, these boxes ought to be ventilated. The Gas Company had remonstrated with them for not attending to this. He suggested that the explosion occurred through an electric spark, and it was the duty of the Electric Light Company to keep their mains and conductors properly insulated, and this had not been done. Mr. J. Cash, Engineer to the defendants, said that when the road was opened it was found that there was a fracture of the gas-pipe; but he could not account for it unless a heavy weight had passed over the ground—the pipe being only 16 inches below the surface. He had called the attention of the Electric Light Company to the culverts not being properly ventilated; and he believed the explosion arose from "sparking." Evidence having been produced to show that there was no indication of leakage of gas in Church Road three days before the explosion, his Honour said he could not see that there had been any want of care or supervision on the part of the Gas Company; and he gave judgment in their favour. Mr. Boxall waived the costs.

MISCELLANEOUS NEWS.

THE SULPHATE OF AMMONIA COMMITTEE.

The Second Annual General Meeting of this Committee was held last Friday, at the Offices of the Chairman (Mr. W. G. Blagden), No. 4, Fenchurch Avenue, E.C.

The minutes of the previous meeting having been read, they were confirmed and signed. The following report, which was accompanied by he accounts, was taken as read:—

The Executive Committee beg to submit to the subscribers an account of their receipts and expenditure for the financial year ending June 30, 1899, and also a report on the work carried out during that period, together with an estimate of expenditure to Dec. 31, 1899.

During the past season, 46 competitions were organized and carried out by Agricultural Societies for the Committee's prizes. Of this number, 23 were English and 23 Scottish Societies. Mr. Hunter, the Committee's Agricultural Adviser, remarks in his report that these competitions have resulted in the gathering from nearly every section of the country of trustworthy information regarding the relative merits of sulphate of ammonia and nitrate of soda, and that in every case in England and Scotland where the competitors have carefully carried out the Committee's instructions, the comparisons are distinctly in favour of sulphate of ammonia.

The Executive Committee have again offered prizes this season to Agricultural Societies, subject to similar conditions to those ruling last year; and 68 Societies have up to now agreed to organize competitions. Of this number, 34 are English, 31 Scottish, and 3 Irish.

There were only three entries for the malting barley competition at the Brewers' Exhibition, and only one prize of £25 was awarded. The barley which gained this prize was of a very high standard; being placed third in the championship, open to the United Kingdom, and taking the first prize in another class, at the same exhibition.

The prize of 500 guineas offered by the Committee for the best essay on the "Utility of Sulphate of Ammonia in Agriculture" has been awarded to Mr. James Muir, M.R.A.C, Instructor in Agriculture to the Somerset County Council; and two other essays, one by Professor R. Warington, M.A., F.R.S., and another by Mr. Alfred Smetham, F.I.C., have been secured by the Executive Committee for 50 guineas each, with a view to having them printed and circulated at a future date. Arrangements are now being made for the publication of the prize essay, and it is expected that it will be ready for circulation in the course of a few weeks.

The pamphlet entitled "A Few Facts about Sulphate of Ammonia" has been revised, and an edition of 100,000 copies printed. Of this number about 90,000 copies have been circulated.

On the termination of Mr. Hunter's appointment as Agricultural Adviser to the Committee in November last, he was re-appointed to that office for a further term of twelve months, at a salary of £200.

During the first four months of this year, the Committee expended slightly under £1000 in a series of advertisements which appeared in 17 agricultural periodicals and 217 provincial newspapers; the latter having been selected with the assistance of the subscribers.

On the 1st of January, the Committee took over the work of the Association of Sulphate of Ammonia Manufacturers, and arrangements have now been made whereby the weekly report on the prices and shipments of ammonia is compiled, printed, and distributed among the subscribers at a cost of about £90 per annum.

As the subscribers to the old Association, who on the 31st of December had not become members of this Committee, would, at the end of the financial year, have only received the benefits accruing from six months' work of the Committee, it was decided that they should be asked to contribute at the rate of 3d. per ton on their annual output of sulphate of ammonia for that period. There were 36 of these subscribers to the old Association—viz., 25 British and 11 Foreign. Of this number only 11 of the British members have as yet joined, and the Foreign members of the old Association all decline to become members of the Committee.

The Committee's Agricultural Adviser considers that it would prove beneficial to the interests of the Committee if more encouragement were given to grain growers, by offering prizes for wheat, barley, oats, &c.; and the Executive would like to benefit by any suggestions that the subscribers may have to make on the subject.

The Committee regret to have to announce the decease of two of the members of the Executive—viz., Mr. Frank Livesey, of the South Metropolitan Gas Company, and Mr. W. Kennedy, of the Broxburn Oil Company, Limited. It has also to announce that Mr. W. W. Woodward, of the Salford Corporation Gas Department, has sent in his resignation as a member of the Executive, and the Committee recommend that the vacancies so caused, be now filled.

The Auditors (Messrs. Alfred Lass, Wood, and Co.) offer themselves for re-election.

The Committee consider that their labours during the past year have met with a large measure of success, and that the increased home consumption of sulphate of ammonia, and the improved condition of the trade generally, justify them in asking the subscribers to continue their support

It was unanimously decided that the report be received and the accounts adopted.

On the proposal of Mr. INGLEBY, seconded by Mr. STANLEY, it was resolved unanimously that an Executive Committee be formed, with full power to appoint officers, to take such steps as they think fit in the interests of sulphate of ammonia manufacturers, and to levy subscriptions as required on members, not exceeding in the whole 6d. per ton during the ensuing year.

On the recommendation of Mr. CHAPMAN, seconded by Mr. JOLLIFFE, it was unanimously decided to re-elect the present members of the Executive Committee, also to elect Mr. Love, of the Broxburn Oil Company, Limited, and Mr. Carpenter, of the South Metropolitan Gas Company, in the places of Messrs. F. Livesey and W. Kennedy, deceased, and to add the names of Mr. R. O. Paterson, of the Cheltenham Gas Company, Mr. A. M. Chance, of Messrs. Chance and Hunt, Limited, of Oldbury, and Mr. F. T. Cotton, of the Alliance and Dublin Consumers' Gas Company, to the list of members of the Executive Committee.

The Auditors were unanimously re-elected, and the proceedings closed with a vote of thanks to the Chairman.

Bingley and the Cullingworth Gas-Works.—The Bingley District Council on Tuesday adopted a recommendation of the Gas Committee to offer to purchase the Cullingworth Gas-Works and certain lands and buildings, for £6500, subject to the re-sale of part of the buildings for £1500.

IS BIRMINGHAM GAS DEAR?

An Article from the "Birmingham Post" of July 21.

The above question has appeared as the heading to several letters in our columns during the last few days from correspondents whose attention has been called to a paragraph relating to the municipal gas-works at Widnes, which is credited with supplying the cheapest gas in the world. Compared with 1s. 3d. per 1000 cubic feet, to which the minimum charge at Widnes has just been reduced, the minimum charge in Birmingham of 2s. per 1000 cubic feet appears somewhat startling; and even taking credit for the £30,000 profit contributed to the rates, leaves a very large difference to be explained. A superficial glance at the circumstances appears to have suggested to one correspondent at least that the Birmingham gas undertaking is extravagantly managed, with the result that he is dissatisfied alike with the profit realized with, and the charges made for, gas. Comments of this character have been made from time to time ever since the Corporation became responsible for the management of the gas undertaking; but they have usually proceeded from persons devoid of the most elementary knowledge of the subject, and in no case have the adverse critics been able to put their finger upon any particular department of the business, and to indicate where an advantageous change could be made. It must not necessarily be assumed from this that the management of the Corporation Gas Department is susceptible of no improvement whatever. But the ineffectiveness of the adverse criticism that has been raised is some evidence in its favour; while it is well known that the City Council has always selected some of its best business men to control the Department. It is hardly to be expected that the details of so huge and complex an undertaking should be familiar to all the members of the City Council, and still less to the burgesses generally. At the same time, there are two sources of information available. The first is the annual report and accounts of the Gas Committee, and the second is "Field's Analysis of Gas Undertakings," an annual *precis* of statistics relating to the principal gas companies and corporation gas-works in the kingdom. This publication tabulates in a very clear form the output of gas, the quantity and cost of coal carbonized, the charge per 1000 cubic feet for each department of manufacture, distribution, and management, together with particulars of prices realized, capital sunk, and profit obtained. And here it may be mentioned that gas manufacture is not a business conducted in a corner. Gas managers and gas engineers work in the light of one another's achievements, and a special literature spreads information of what is being done, and subjects every department to expert criticism. In the light of the information thus available, it may be useful to examine the principal circumstances pertaining to the Birmingham gas undertaking, with a view to ascertain whether, as regards profit or price, there is any substantial ground for complaints.

The capital of the Birmingham gas undertaking, as shown by the balance-sheet of the 31st of March last, is, in round figures, £2,360,300. The mistake is occasionally made of comparing this sum with the £30,000 carried to the rates, and considering the £30,000 as a very trifling dividend paid upon the concern. It is forgotten that £30,000 is not the entire profit, but a surplus. The gross profit on the year's manufacture was £131,300, which is as nearly as possible 5½ per cent. on the entire capital. There are great variations in the results shown by different concerns; but the local circumstances vary greatly. Among these may be mentioned cost of coal, and price realized for residuals. The former is chiefly a question of proximity to the best gas-coal producing districts, while the latter is affected by proximity to the sea; the majority of tar products, and large quantities both of sulphate of ammonia and of coke, being sold for export. Rates and taxes also vary considerably; and there are other details which have to be taken into account. When all the factors are brought into the sum, we believe Birmingham has no reason to be ashamed of the comparisons that are invited. Take the question of gross profits. It must first be remembered that if the concern were a company, a large part of the capital would be debenture stock at 4 per cent. or under, that another large part would be preference stock, and the remainder ordinary stock at rates varying from 6 to 10 per cent. For instance, the three great London Companies have 3 to 4½ per cent. debentures, 4 per cent. preference stock, and ordinary share capital at 6 to 10 per cent. The Gaslight and Coke Company has a capital of £13,106,000, and their gross profit last year was £1,169,000, or not quite 9 per cent.; but their average price for gas is 2s. 10½d. per 1000 cubic feet, as compared with an average charge in Birmingham of 2s. 1½d. Take a Provincial Gas Company for comparison. The Sheffield Gas Company has a capital of £865,000, and shows a gross profit of £78,000, or again about 9 per cent. Sheffield has very cheap gas; the average charge, including meter-rents, being 1s. 11d. per 1000 feet. In this case, however, the Company enjoys the advantage of closeness to the sources of gas coal; and the metal trades are large consumers of coke. The coal, however, is perhaps the chief factor, for Sheffield pays for coal only 9¾d. per 1000 cubic feet of gas sold, as compared with 1s. 0½d. that has to be paid by Birmingham. The Manchester gas is a municipal undertaking; and there, according to "Field's Analysis," the capital is £1,970,000, and the gross profit £113,800, equal to 5¾ per cent. These figures are very near to those of Birmingham. Manchester has a little more to pay for coal; but the average net price charged to gas consumers is 2s. 4½d. per 1000 cubic feet, or 3¼d. more than in Birmingham. The Nottingham Corporation gas undertaking has a capital of £1,057,000, and shows a gross profit of £75,167, or 7 per cent.; but the average price of gas is 2s. 5½d. per 1000 feet, *plus* 1d. per 1000 feet for meter-rent, while coal costs Nottingham ¾d. less per 1000 cubic feet of gas produced than Birmingham.

We take from "Field's Analysis" the following particulars of eight of the largest municipal gas undertakings in the country, so far as relates to their average net charge per 1000 cubic feet of gas:—

	Meter-Rent.		Gas Charge per 1000 Ft.		Total.
Birmingham	*nil*	..	25·21d.	—	25·21d.
Bolton	0·29d.	..	30·83d.	—	31·12d.
Carlisle	0·81d.	..	27·32d.	—	28·13d.
Leicester	*nil*	..	28·29d.	—	28·29d.
Manchester	0·19d.	..	28·54d.	—	28·63d.
Nottingham	0·95d.	..	29·22d.	—	30·17d.
Oldham	*nil*	..	25·25d.	—	25·25d.
Salford	*nil*	..	26·24d.	—	26·24d.

The average net gas-rental of the eight Corporations, excluding meter-rents, is 27·17d. per 1000 cubic feet. Birmingham has the lowest charge of the series, and Bolton the highest. The same authority gives the corresponding statistics of eight Provincial English Gas Companies, as follows:—

	Meter-Rent.		Gas Charge per 1000 Ft.		Total.
Bath	1·03d.	..	30·19d.	—	31·32d.
Brighton	1·07d.	..	33 23d.	—	34·30d.
Bristol	0·56d.	..	27 66d.	—	28·22d.
Newcastle-on-Tyne	0·85d.	..	20·49d.	—	21·34d.
Plymouth	1·23d.	..	21·26d.	—	22 49d.
Portsea	1·33d.	..	27·47d.	—	28 80d.
Rochester	0·47d.	..	27·50d.	—	28·03d.
Sheffield	1·18d.	..	21 77d.	—	22·95d.

It will be seen that five of the eight towns in the foregoing table have higher gas charges than Birmingham. The special advantages of Sheffield have already been referred to. Newcastle, which has a lower charge than Birmingham, is able to get its coal at 3d. per 1000 cubic feet of gas less than Birmingham. Plymouth, on the other hand, has to pay 2d. more for coal than Birmingham; but it possesses the great advantage of having one of the smallest capital accounts in the kingdom—its capital bearing the proportion of 6s. 8d. for every 1000 cubic feet of gas sold per annum; whereas the average of the eight Corporations is 10s. 10d., and of the eight private Companies in the foregoing table 9s. 5d.

The proportion of capital in relation to the quantity of gas sold is one of the criteria by which the prosperity of gas undertakings is judged. From this point of view, private companies compare favourably with municipal undertakings; but this is due to the circumstance that in acquiring their gas-works the municipalities have been compelled to pay a large sum for goodwill. It speaks well for municipal control that, notwithstanding this, the municipal capital accounts are so low. Birmingham, as already stated, has a capital item of 10s. 10d. per 1000 cubic feet sold per annum. This is the lowest of the eight quoted Corporations. The average capital of the three London Gas Companies is 11s. 2d. per 1000 cubic feet of gas sold; the lowest of the three being 8s. 8d., and the highest 12s. 6d.

A suggestion has been made that the salaries of the staff in Birmingham are unduly high. The average "salaries" of the eight Corporation concerns already referred to, and comprising manufacture, distribution (including meter inspectors' wages), and management (secretary and accountants), counts up to 1·49d.; whereas the charge in Birmingham is 1·12d. Limiting the comparison to management and manufacturing charges only, the general average is 0·48d. and that in Birmingham 0·42d. per 1000 cubic feet of gas sold. It is clear, therefore, that under this head there is neither extravagance, nor any possibility of appreciable saving.

Of the gross profit of £131,300 realized last year on gas making in Birmingham, £101,000 is required to pay the annuities to the stockholders in the old Staffordshire Gas Company, and to defray interest on capital and sinking fund; a dividend to the former of 7½ and 10 per cent., chiefly the latter. The £30,000 which is voted in relief of the rates is the extra profit derived from the economies effected by the Corporation management; and the development of the undertaking since it was taken over. In addition, however, to this, £4000 interest on the reserve fund goes to the rates; and the Gas Department have reduced the charges for public lighting by £16,500 a year. But for this latter reduction the gross profit shown would be £147,800, or 6¼ per cent. on the entire capital. With regard to Widnes—the case which provoked the correspondence—we have been unable to obtain any recent figures; but we notice from a parliamentary return for 1897 that, whereas the charges to consumers inside the borough were 1s. 8d. and 1s. 10d. per 1000 cubic feet, those outside were called upon to pay 1s. 10d. and 3s., in addition to meter-rents of varying amount. The charges inside the town have since been reduced to the figures which have attracted general attention; but there is no statement as to the outside charges.* By Act of Parliament, the Corporation of Birmingham are bound to charge the same price to the outside districts as to burgesses of the city; and to this is due the circumstance that the Local Authorities outside are content to take their gas from Birmingham instead of starting their own concerns. The arrangement is one which Birmingham people may consider not quite equitable; but it was entered into after full consideration of the subject, and under the pressure of a Parliamentary Committee.

EUROPEAN GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held on Monday last week, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. J. Blacket Gill in the chair.

The Secretary and General Manager (Mr. W. Williams) read the notice convening the meeting, and also the following report of the Directors:—

The Directors are able to report an increase in the consumption of gas at most of the Company's stations. The increase amounts, in the aggregate, to 2 per cent., and is mainly due to the extended use of gas among small consumers, who have been induced to take either prepayment meters or fittings on hire.

Coals have cost more than during the preceding year; and the extra cost has only been partly recouped by the enhanced value of coke and an improved return from sulphate. The revenue from tar has been less.

The new gasholder at Havre will be ready for use this winter, when it will be urgently needed, as the consumption of gas at Havre continues to make considerable progress.

The Directors have the satisfaction of reporting that, after protracted negotiations, they have succeeded in obtaining a prolongation of 25 years of the Company's concessions for lighting the town of Boulogne, and its neighbouring communes. This extension, which will bring the treaties in question to 1932, was only secured by making very considerable reductions in the price of gas; but the Directors trust that lower prices will bring an increase of business, and enable the Company better to compete with other illuminants.

The profits have been unfavourably affected by the increased cost of coal,

* The charges outside the borough were published in last week's issue, p. 185.—Ed. J.G.L.

and are not quite sufficient to pay the same dividend and bonus as last year. But the Directors propose to take the difference required to make up the amount (£386) from undivided profits; and they therefore recommend the payment of the usual dividend—viz., 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, less the interim dividend of 8s. and 6s. per share respectively paid on the 1st of February last; also the payment of a special bonus of 1 per cent. on all shares, according to the amount paid thereon. The Directors, however, recommend that the declaration of dividend be made subject to the following proviso: "This payment shall, as regards French shareholders, be made under reservation of the right of the Company to recover from such shareholders, by deduction from subsequent dividends or otherwise, any duty or tax imposed by the law of their country, and which the Company may be called upon to pay." The reason for inserting this reservation is that the French Government claim a tax on such of the Company's shares as are held by French shareholders. The matter is still under discussion with the French Revenue Department, so that the Directors do not think it advisable at present to do more than make the above reservation.

In connection with the same subject, the Directors, having regard to the difficulty of ascertaining whether share warrants to bearer are in French or English hands, have, by resolution, decided to cease the further issue of such warrants. Holders of the same may at any time have their warrants converted into registered shares free of charge.

Notice has been given that two Directors (Henry C. Smith, Esq., and J. Blacket Gill, Esq.) and both Auditors (J. Reeson, Esq., and F. M. Fry, Esq.) retire from office at this meeting; but, all being eligible, they offer themselves for re-election.

The CHAIRMAN said the report entered very fully into the history of the Company during the past year; and he did not think the shareholders would thank him if that warm afternoon he kept them very long in dealing with the affairs of the Company, which, he was glad to say, were in a most satisfactory condition. He might, however, refer to a few of the important items. The gas-rental amounted to £254,078, which was an increase of £4574, or 2 per cent., upon the past year. In the preceding year, the increase was about 4 per cent., or rather more. But when they considered the very extraordinary amount of opposition they received on all hands from the electric lighting companies, he thought that altogether the result was very satisfactory. Taking all the stations, they had no less than 54,000 stoves in use, and 421 gas-engines. The number of consumers was 42,504, which was an increase of 2882; and this was largely accounted for by the number of coin meters now in use—6050. Coal had cost £97,000, which was an increase of £6000. A great deal of this was due to the fact that they had had to pay considerably more for coal in consequence of the South Wales strike; but it had been recouped to a certain extent by the additional £3399 received from coke sales. Tar had not served them very well; and they had lost £1681 upon it as compared with the previous year. On the other hand, sulphate of ammonia showed an improvement of £1386; the total receipts for that material being £5111. The bad debts only amounted to £670, which was a modest sum upon the large rental received. The total mileage of mains was now 462; there having been an increase of 5 miles during the year. The profit on the year's operations was £82,293, which was a decrease of £1875 compared with the preceding year. Out of this, the Directors proposed to pay the usual 10 per cent. dividend, which would take £75,163, and a bonus of 1 per cent., which would require £7516. In order to make up the amount, they would have to take the small sum of £386 from their reserve of undivided profits. The investments had increased by £3250, representing the value of certain shares they had bought in the Rouen Gas Company, who supplied the part of the town not lighted by the European Company. The Directors thought this was a very fair investment. He always looked at this portion of the accounts with very great pleasure; and he hoped the investments would remain at their present substantial figures for many years to come. When one considered the increased price of coal and the political unrest that was constantly going on in the country where their works were, it was a most satisfactory thing to feel they had always something to fall back upon in case of stress. At Havre, during the past year, they had been completing the new gasholder. Only £4000 of the cost had been charged to last year; and the remainder (which, he supposed, would be £6000 or £7000) would come into this year's accounts. It would be a very great advantage to the Company to have this holder, as they had been short of storage at Havre for some years past; and, really, they had only hesitated to put it up on account of the high duty they had to pay the French Government on gasholders. At Bolbec, the law suit to which he referred at the last meeting was still going on. It was a small affair, as the shareholders were aware; and it only related to the adoption by the town of electricity instead of gas—the contention of the Directors being that the town ought to have paid the Company some compensation. Although only a small matter, it was still drawing its weary length along in the French law-courts. At Boulogne, they had a fresh concession for 25 years, making the total length of their concession there 33¾ years. This had not been obtained without a considerable amount of exertion on the part of their excellent General Manager (Mr. Williams), who was ably assisted by the Company's Director in Boulogne (M. Huon). The shareholders would understand that, in getting a concession of this sort, the Company had themselves to concede a good deal. The price was now somewhat low; but it was a good thing to feel settled for over thirty years. Then he came to another matter, which had given the Directors a considerable amount of trouble, and that was the tax upon their coupons in France. The report stated how the Directors intended to pass the dividend with this proviso: "This payment shall, as regards the French shareholders, be made under reservation of the right of the Company to recover from such shareholders, by deduction from subsequent dividends or otherwise, any duty or tax imposed by the law of their country, and which the Company may be called upon to pay." The matter was still under discussion with the authorities; and therefore it would not be wise to enter very fully into it. But the Board had nothing to hide from the proprietors; and they thought it only right they should mention it. In short, they had passed a resolution that in future they would have no more share warrants to bearer; and it would give them much pleasure if any English shareholders who had any would send them in, and have them converted into ordinary certificated shares, perfectly free of charge. As to the past, he was very much afraid the French authorities would come down upon the Company; and they would have to pay something for duty on the shares issued. Of course, they did not know they were chargeable for them; but they would be able in the future to deduct from the dividends of the French shareholder the tax upon his shares. He should like to mention that they had given this matter a great deal of consideration; and they had had to guide them a most excellent French barrister, who had before done good service for the Company. In addition, they had taken the opinion of an English barrister in connection with their proposed proceeding in regard to the dividend. By the time the shareholders met again, he hoped the worry in connection with this matter would have passed away. During the year, he was sorry to say, they had the misfortune to lose one of their Directors, M. Zienkowicz, at Caen, who had served the Company faithfully for many years. The Board had appointed as his successor (M. Coudelou), who had been their Sub-Engineer at Havre; and from what they had seen of him, they believed he was the right man in the right place. They had also a new Manager at Boulogne (M. Huon), who assisted Mr. Williams in obtaining the prolongation of the concession for that town. Both Mr. Williams and himself (the Chairman) visited the works during the spring; and all they saw gave them considerable satisfaction. He might conclude, as he did last year, by saying that he thought the Company were in a most excellent position, and that there was every probability that they would be able to present to the shareholders this time next year as good a report as they had the pleasure of doing that day. He then moved that the report of the Directors and the statement of accounts be received and adopted.

Mr. N. E. B. GAREY seconded the motion, which was unanimously carried.

The CHAIRMAN next proposed the declaration of the dividends recommended in the report; again drawing attention to the reservation of the right to recover from the French shareholders any duty or tax imposed by the French Government. He said he wished to make this as public as possible; and he asked the shareholders to assist the Directors in doing so. The Board had given notice that the bearer shares would be discontinued in future. The matter, however, was one which it was as well they should not discuss, as the Board would not know perhaps for five or six weeks what the Company would be called upon to pay.

Mr. GAREY seconded the motion.

Mr. H. E. JONES remarked that he understood there would be no direct call upon the ordinary shareholders, but any expense incurred would fall on the whole Company.

The CHAIRMAN replied that, when the French authorities had settled what sum would have to be paid, he was afraid the whole Company would have to bear the loss. It was a very unfortunate occurrence, and was quite beyond the control of the Board. What the amount would be, they could not say yet; but they were doing their best to get it as light as possible.

Mr. JONES said he gathered that, when once they had paid the arrears, future contributions would have to be paid by the French shareholders.

The CHAIRMAN: That is so.

The proposition was agreed to.

On the motion of Mr. E. T. E. BESLEY, Q.C., seconded by Mr. E. F. WHITE, the retiring Directors (Messrs. H. C. Smith and J. Blacket Gill) were unanimously re-elected.

Mr. JONES next proposed, and Mr. A. T. EASTMAN seconded, the re-appointment of the Auditors (Messrs. J. Reeson and F. M. Fry); and this was also carried.

The usual complimentary votes to the Chairman and Directors and the officers at home and abroad concluded the proceedings.

INCANDESCENT GAS v. ELECTRIC LIGHTING FOR NEWMARKET.

In the "JOURNAL" last week we briefly referred to the tenders for the public lighting of Newmarket which have been submitted to the District Council by the Engineer and Secretary of the Gas Company (Mr. J. H. Troughton), and the Secretary of the Electric Light Company (Mr. A. Harold Ruston) respectively.

In submitting his tenders, Mr. Troughton pointed out that his Directors had not quoted a price for one or two years, as the present system of lighting was obsolete, and so much more costly as compared with the illuminating effect of the systems now offered; also believing it was the wish of the Council to improve the lighting of the district. The lanterns and burners the Company proposed to erect combined the latest improvements in street lighting; and as the minimum candle power was given, the burners when new would give considerably more light than was stated. In the event of a comparison being made of the Welsbach burners with electric arc lamps, he pointed out that a 500-watt electric arc lamp was usually credited with a theoretical value of 1000 candles; whereas, because the light was so irritating that it had to be obscured by a ground-glass globe, and from other causes, the light given was not more than one-third or one-fourth of the nominal candle power at which it was rated. If higher power lights were required, the Company could furnish them by means of clusters of incandescent gas-lamps at a rate very much lower than the charge for electric arc lights. As modern authorities were decidedly in favour of moderate power lamps at comparatively short distances apart, the Company had not quoted for higher than 200-candle power lamps. The special attention of the Council was drawn to tenders Nos. 1 and 2, under either of which schemes Newmarket could, Mr. Troughton believed, be made the best-lighted town in the Eastern Counties. After referring to the great improvements which have been made in gas engineering, he said his Company were willing, under a contract for three years, to substitute new and modern lanterns fitted with No. 4 Welsbach incandescent burners, giving a light of from 105 to 120 candle power, for the present ordinary lamps of from 12 to 15 candle power. These new burners would also be substituted for the "C" incandescent burners in the High Street and Upper Station Road; doubling the candle power in those streets. The 18 Sugg lamps would be fitted with two new incandescent burners, giving from 210 to 240 candle power in place of 90-candle power as at present. The Company would also provide the new burners and make the alterations at their own expense, if the Council would pay £900 per annum; any increase in the number of hours alight or lamps lighted to be paid for in proportion. The other terms were to be as per last contract, with the exception of the clause relating to a reduction if the price

of gas to ordinary consumers was reduced. Under this system, the Company would give an illuminating effect of 25,095 candles, as against 3936 candles obtained from the lamps now in use. The present price was £922. For five years the price would be £850 per annum. Tender No. 3 embraced the substitution of No. 3 Welsbach incandescent lights for the present lights, which would give an illuminating power of 19,120 candles. The price for this was £825 per annum for a contract for three years; or £775 for one for five years. Tender No. 5 embraced the substitution of No. 2 incandescent burners for those now in use, giving a light of from 50 to 60 candle power, and putting in each of the 18 Sugg lamps two No. 4 burners. For a contract for five years under this system the Company would accept £750 per annum.

Mr. Ruston submitted two schemes. One was to light the whole of the existing lamps for the hours they are now in use, supplying lamps of at least the same illuminating power as at present—*i.e.*, substituting for the 174 ordinary gas-lamps 174 electric lamps of 16-candle power each; for 24 incandescent lamps, 24 electric lamps of 32-candle power each; for four 2-light Sugg lamps, two arc lamps of 800-candle power each; for 14 3-light Sugg lamps, 14 arc lamps of 800-candle power each. The cost of this service, including the supplying of the necessary posts and lanterns, would be, under a contract for three years, as follows: 174 16-candle power lamps, at £3, £522; 24 32-candle power lamps, at £5, £120; 16 arc lamps, at £15, £256—total, £898. In short-period contracts, it was more usual for the Council to provide the necessary posts and lanterns, and the supplying company all the electrical apparatus required. If this was done, they could reduce their price to £807 15s., as against an expenditure on the present lighting of £943. The second scheme embraced the reorganization of the lighting of High Street and Wellington Street, by placing in the former 16 arc lamps of 1000-candle power each, about 70 yards apart in the busier portion, and from 80 to 100 yards elsewhere; and in Wellington Street four lamps of the same size. Tall lamp-posts, which could be supplied for about £14 10s. each, were recommended for the arc lamps, so as to get an even distribution of light. The cost of lighting these two streets would be, at £16 per lamp, £320; or, if the Council supplied the posts, at £15 per lamp, £300, as against a present cost of about £255. This showed a proposed increase of some £45, or about 18 per cent., for an increase of about 1000 per cent. in light. The present candle power was 1718, as against a proposed 20,000-candle power. Allowing for the arcs being placed farther apart, it was safe to say that the two streets would be at least five times as well lit as at present. The Company were prepared to light these streets only, or would substitute for the remaining ordinary incandescent and 3-light lamps an equivalent number of 16, 32, and 800 candle power lamps for £644, or £578 10s. if the Council supplied the posts, &c.; making a total of £878 10s. They would provide the posts and sell them to the Council, adding a sum to each of the twelve quarterly payments to cover the cost.

The tenders are under the consideration of the Lighting Committee of the Council.

ELECTRIC LIGHTING NOTES.

The Electric Lighting Committee of the Liverpool Corporation last Friday resolved to recommend an application to the Local Government Board for sanction to borrow £300,000 for the development of electric lighting, &c., within the city.

Sanction has been given to the Lowestoft Town Council to borrow £30,000 for electric lighting works. A new contract has just been entered into with the Gas Company for lighting the town up to June 24, 1900; but it is hoped that by 1901 the larger portion will be illuminated by electricity.

A commencement was made with the street lighting of Shrewsbury by electricity last Saturday week. Evidently the Corporation were in a great hurry to show the ratepayers what could be done with their new acquisition, for on the evening in question only four arc lamps were prepared to drop into service.

The Eton District Council last Wednesday debated at considerable length the question of public lighting by electricity and gas; and finally they adopted a recommendation of a Committee that "Eton be lit by the electric light, and that they be instructed to deal with the Windsor Electrical Installation Company."

The work of laying down an electric lighting system in the principal thoroughfares of Leigh was commenced last Tuesday. The District Council have obtained the sanction of the Local Government Board to a loan of £10,000; and the work, it is expected, will be completed in time to supply energy in the coming winter.

The Rawdon District Council have determined not to offer opposition to a proposed application of Messrs. Greenwood and Bailey for a Provisional Order for lighting the district by electricity. Had the purchase clause put forward by the Local Authorities been inserted in the Yeadon and Guiseley Gas Company's Bill, the decision might have been otherwise.

It was announced, at last Tuesday's meeting of the Coventry City Council, that a further loan has been sanctioned in connection with the Electric Lighting Department; making £33,000 for extension works. The Council also settled a scale of charges for the use of electrical energy for motive power: Up to 260 units 4d. per unit, up to 520 units 3d., above 520 units 2d. per unit.

The Bristol Electrical Committee have been advised of the sanction of the Local Government Board to the raising of a loan of £41,650 for extension works. A Company has been formed for the purpose of wiring the premises of consumers. They will look for payment to the Committee, who will charge the consumers for the use of the installation 1d. per unit of electricity used.

At a meeting of the Gas and Electricity Supply Committee of the Bradford Corporation last Friday, it was stated that, in consequence of the increasing demand for current for electric lighting and the proposed tramway extensions, it would shortly be necessary to enlarge the electricity works. A Sub-Committee were appointed to go into the question; the probable cost of the extensions being estimated roughly at £50,000.

There was no opposition at a Local Government Board inquiry held by Colonel Marsh at Radcliffe last Tuesday into an application by the District Council for sanction to them borrowing £16,000 for an electric lighting plant, which, it is estimated, will be capable of running 4000 8-candle power lamps. It was stated that promises of support have been received, and the Council themselves will be large consumers. This is usually found absolutely necessary in order to make the business pay.

A report by a firm of Electrical Engineers on the subject of electric lighting and traction for Batley has been circulated among the members of the Town Council for consideration. The report is a most exhaustive one. The cost of electric light is put down at £16,770, and that for electric traction at £69,000. It is anticipated that other expenses would bring the total cost of the joint scheme up to £100,000. The Corporation are not as yet pledged to any scheme. The overhead system of traction is strongly recommended as being more suitable to the district, and less costly than the conduit system.

Last Thursday, Mr. Meade-King, Local Government Board Inspector, held an inquiry at the Town Hall, Derby, in reference to an application from the Town Council to borrow £25,000 for electric lighting purposes. Mr. T. P. Wilmshurst, the Borough Electrical Engineer, explained that the money was wanted for extensions of the works and to put down new plant. The present plant was of 1800-horse power, and, assuming that the whole of it was worked, it would supply 18,000 16-candle lamps. The number of street-lamps was 77 arc and about 50 incandescent. The private lighting was 14,500 16-candle lamps. The new plant would supply 10,000 such lamps. Only additional incandescent street lighting was proposed; and the current would be taken from the ordinary mains. Plans, &c., were examined by the Inspector.

The Hoylake and West Kirby District Council have committed themselves to an expenditure of £26,000 for an electric lighting installation. By this, provision will be made for 7000 8-candle power lamps, which, it is believed, can be counted upon. The total annual expenditure, including working expenses for the production of energy, and repayment of principal and interest, is estimated at about £3250, and the revenue at £3500. Thus, assuming the happy anticipations of the Council are realized, the profit will be a narrow one. But uncalculated contingencies and extensions will have to be met and arranged for before the 7000 lamps are fixed; and the time when the Council will be able to handle profits is, we fear, far ahead. It is stated that the Gas Company have given notice to reduce their price to 3s. 6d. per 1000 cubic feet; and the Council are taking some credit for this to themselves—their action, they say, in regard to the electric light having stirred up the Company

The Bedford Corporation electricity installation continues to increase its capital and loan burden. At the Council meeting on Wednesday, the Committee submitted estimates for extensions to the plant, mains, buildings, and machinery, amounting to £41,000. The Chairman (Alderman Richards) said that this new scheme would embrace the whole of the town. The Committee had got to the end of their borrowing powers, and it would fully tax the capacity of the plant to meet the increasing demand next winter. By proceeding with great expedition, they would just be able to obtain what was necessary by the time it was wanted. The new scheme of extension provided for public and private lighting in all parts of the town. Last year, after repayment of principal and interest, amounting to £3159, the charge on the rates was £981. By taking steps to meet the greater demand, they hoped to increase the net revenue account; and thus a valuable property, of which the town could be justly proud, would be acquired. The estimates were adopted. Application will accordingly be made to the Local Government Board for the £41,000 required. We believe the capital already borrowed for the undertaking is nearly £60,000 The population of Bedford is about 35,000; and the Corporation are confronted at the present time with expenditure for schemes of water supply and sewage disposal.

The Assessment of the Blaenavon (Mon.) Gas-Works.—The Blaenavon Gas and Water Company appeared before the Assessment Committee of the Abergavenny Union on Tuesday last to object to the rateable value placed on their gas-works; the water portion of the undertaking having recently been sold by arbitration to the District Council. The rateable value had been put at £800; whereas the computation of Messrs. Newbigging and Son amounted to £523. After hearing evidence, the Committee agreed to reduce their amount to £550. Mr. Watkins, Solicitor, of Pontypool, the Gas Manager (Mr. C. White), and Mr. Newbigging were present on behalf of the Company.

Widnes and its Record.—Speaking after dinner on the occasion of the annual inspection of the Widnes corporate estate, last Tuesday, the Mayor (Alderman J. W. Wareing), who presided, said that by the recent reduction in the price of gas to 1s. 5d. and 1s. 3d. per 1000 cubic feet, Widnes had created nothing short of a *furore* in the gas world. He had received numerous letters asking for permission to view the works and for information regarding them; and he understood the Engineer had been inundated by such requests. They were proud of their gas-works. Many other complimentary allusions were made to the gas undertaking, and in responding to a toast, the Gas Engineer, Mr. Isaac Carr, said that the attention of every gas maker of note throughout the world was now centred upon Widnes. The question of economy in gas production must force itself upon people, because the advantages of gas were so manifold; and it should be placed at the disposal of the community in the easiest possible manner. His friends in the gas profession would follow in the footsteps of Widnes.

Lincoln Corporation Water-Works.—The Water-Works Committee of the Lincoln Corporation have had the question of obtaining an increased supply of water under their consideration for some time past, and observing the steps being taken by the Gainsborough Urban District Council to obtain a supply from the Keuper and Bunter beds of the Old Red Sandstone by means of deep borings, they have—after obtaining reports from Mr. De Rance and Professor Hull, the eminent geologists—decided to undertake a similar scheme to supplement the existing supply from the River Witham. The Committee have selected Mr. Percy Griffith, Assoc.M.Inst.C.E., F.G.S., as Consulting Engineer to superintend the new works, he having had special experience in this class of work in connection with the Gainsborough scheme, for which he has acted as Consulting Engineer since the death of his partner, the late Mr. Jabez Church, in 1896. The proposed boring will, it is expected, be from 1500 to 2000 feet deep; and as it will take some three years to carry out, it will be put in hand as early as possible.

NEW CHIMNEYS FOR INCANDESCENT GAS LIGHTING.

Each lighting season now brings its novelties in connection with incandescent gas lighting; and not a few of the useful ones have emanated from the establishment of Messrs. Falk, Stadelmann, and Co., of Farringdon Road. The last we noticed was the "Jena" gas bulb with lateral air supply; and now the firm have applied, with success, the same principle to chimneys for use with the Welsbach "C" or York burners. The chimneys are made in a variety of lengths and diameters to suit all conditions of indoor and outdoor lighting; but it will suffice to describe two or three of the arrangements. Taking first the chimney which has been named the "Normal." An air-diverting cone is slipped over the burner-head, in order to exclude the air supply to the centre of the burner; the air necessary to support combustion being introduced at the side of the chimney. On the base of the air-deflector are three flanges which can be raised or flattened as required for the purpose of lifting or lowering the chimney, so as to adjust the lateral air-holes in

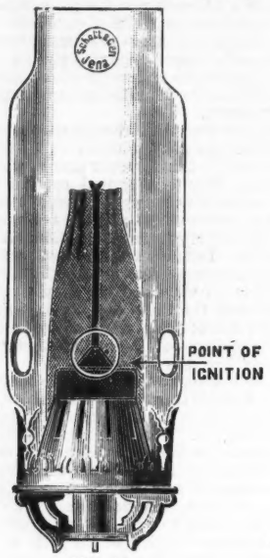


Fig. 1.

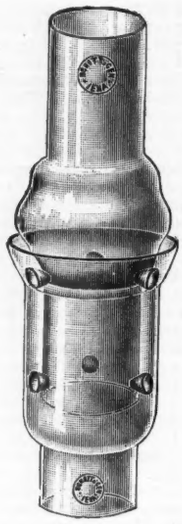


Fig. 2.

such a position that their lower edges are not more than ¼ inch below the point of ignition—thus causing (as seen in fig. 1) rather more than half of the holes to be above the burner head. This is an essential condition for obtaining the best results. We are informed that tests conclusively show that the effect of the lateral air supply is an increase in illuminating power of fully 33⅓ per cent. compared with a Welsbach "C" burner as ordinarily fitted. Another advantage is that the chimneys being of greater diameter than the ordinary straight ones, there is no deposition on the interior; and consequently there is no obstruction of the light, and cleaning is rendered less frequent. The next arrangement which calls for notice is the "Suspension" set; and in this we recognize the adaptation of an old friend to incandescent gas lighting (fig. 2). For the special purpose for which it has been designed, there is no doubt that it is particularly useful. In draughty places and in street lanterns which are not entirely windproof, it furnishes admirable protection for the mantles, in addition to which is claimed a greatly increased illumination. The burner is fitted with a wind shield (fig. 3); and, in this case, there are two glasses—an inside chimney and an outside cup. The latter only reaches about half way up the chimney, which in its turn does not fit closely down on to the burner. Consequently, the air supply is drawn down the annular space formed by the two glasses, and thus becomes superheated before it reaches the mantle; and to this is ascribed an increase of 40 per cent. in the illuminating power. The light afforded by one which we have seen in use was undeniably very brilliant. The firm are also introducing a new globe for incandescent lighting made of a special glass called "Opalene." While softening the light, it is said that by its use there is only a loss of about 10 per cent. of the illuminating value, as compared with 30 to 40 per cent. with ordinary obscured glass or opal. All the chimneys are made of "Jena" glass, the merits of which are now well known.

Fig. 3.

Leighton Buzzard Water Supply.—Colonel C. B. Luard, R.E., recently held a public inquiry, on behalf of the Local Government Board, into an application on behalf of the Leighton Buzzard Urban District Council to borrow £500 for the purpose of providing polarite filters upon the new system adopted by the Corporation of Hastings, the Southwold Water Company, and other places. The Leighton water, being obtained from the lower greensand, contains much iron in solution, which requires oxidizing and removing; and although the water is otherwise of high organic purity, its brown appearance has been a source of inconvenience and great complaint. In order to meet a widespread desire for a clearer supply, the Town Council decided to establish an efficient system of filtration, and after lengthened investigation and trials eventually selected the above-mentioned system.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Rejection of the East London Water Bill.

At the Meeting of the London County Council last Tuesday, the Parliamentary Committee presented a report in reference to their proceedings on the East London Water Bill. The Committee pointed out that the Company sought powers to abstract a further quantity of water from the River Thames, to construct very large additional storage reservoirs in the valley of the Lea, to put a further debenture stock charge of £1,400,000 on the undertaking, and to enter into agreements with other Water Companies with respect to mutual assistance. The Committee considered that the objections to the Bill were as follows: (1) That it would prejudge some of the important points in the London Water Question now under the consideration of the Royal Commission. (2) That the Council's scheme for dealing with the water question having been deferred by the action of the Government pending the issue of the report of the Royal Commission, the proper course was also to defer a Bill of this class brought in by a Company. (3) That there was no immediate necessity for the Bill, as everything required to meet any pressing emergency had been dealt with by a special interim report of the Royal Commission, and by a Bill introduced thereon by Her Majesty's Government, and now passed into law. (4) That while the powers conferred on the Water Companies by the Government Bill (following the precedents of recent Acts) had been made subject to a provision that "in the event of purchase they should not be held to enhance the price of the undertakings," the East London Company sought similar powers, but without a corresponding clause as to the enhancement of price. (5) That the only possible explanation of this procedure was that the Bill might enable the Company, in the event of purchase, to claim under their Special Act purchase-money at a higher rate, because they were exempt from the provisions of the Government Bill; the other seven Companies being subject, in respect of the same power, to the provisions of that Bill. (6) That a populous and fast-growing district in the suburbs of London was an unsuitable situation for very large storage reservoirs for domestic supply. The Committee went on to state that the Local Government Board, in their official reports to both Houses of Parliament, and in a letter addressed to the Chairman of the Committee of the House of Commons, appeared to be of the same opinion as the Council, that much of the Bill would be unnecessary if the Government Bill passed. Mr. Chaplin, however, appeared to be of a different opinion; it being almost openly stated for the Company before the Committee of the House of Commons that they could rely on Mr. Chaplin's support in the House, notwithstanding the official expression of opinion by his Department. On the consideration of the Bill in the House of Commons, Mr. Stuart moved the insertion of a clause in precisely the same terms as clause 3 of the Government Bill, and offered to the Directors of the Company that in the event of their accepting it the assent of the Council might be secured to their Bill. The Directors declined the clause; and on a division in the House of Commons on the 12th of May the motion to insert it was defeated by a majority of 185 to 73—Mr. Chaplin and other members of the Government voting with the Directors against it. In the House of Lords the whole matter was carefully considered for four or five days by a Committee composed of peers who were all followers of the Government; and they rejected the Bill. After mentioning that the measure was also opposed by the County Councils of Middlesex and Hertfordshire, and by the County Borough of West Ham, the Committee attributed the rejection of the Bill to "this general opposition, and largely to the refusal by the Directors of the Company who are members of the House of Commons to accept the very reasonable compromise which was offered to them on behalf of the London County Council by Mr. James Stuart." They concluded by referring to the formal statement sent to the Local Government Board by the Chairman of the Company (Colonel Lockwood), and published in the "Journal" for the 4th inst., putting upon the Council the responsibility for the rejection of the Bill. The Committee, however, refused to admit any such responsibility, and attributed the Company's parliamentary failures to "their own methods of procedure, and the general hostility which these have evoked from the important districts supplied by them without as well as within the county of London."

On the motion for the reception of the report, Mr. Beachcroft moved, as an amendment, that it be referred back to the Committee. He disputed, on the authority of the East London Water Company's Solicitor, the accuracy of the statements contained in the report. He said Mr. Stuart made it a condition of the withdrawal of opposition that the Company should promise to support the Council's Bill. He complained that by the action of the Council the Bill had been thrown out, while they were again threatened with want of water through the prevailing drought. He thought that before the recess the Water Committee should bring up some suggestions for allowing an overdraught from the Thames. Mr. H. P. Harris, in seconding the amendment, objected to the terms in which Mr. Chaplin and other members of the Government had been referred to in the report. Mr. Cornwall (Chairman of the Parliamentary Committee) defended the accuracy of the report, and stated that the Committee relied for their information on Mr. Stuart and their Parliamentary Agent. The question of drought had really nothing to do with the rejection of the Bill. No number of additional reservoirs in the Lea Valley could prevent a famine if the Thames ran dry. The great difficulty the Council found in dealing with the water question was that some of the members would not give up their special pleading for the Companies. The Council had too long been wearing the kid gloves; but at last they had spoken up, and when the East London Bill was before the House of Lords Committee they plainly told the Committee that Mr. Chaplin had sold the Council. Mr. Cohen supported Mr. Harris in his objections to the wording of the report, which he characterized as offensive. Mr. Dickinson (Chairman of the Water Committee) said there was no reason to apprehend a water famine in East London so long as the other Water Companies were able to support the East London Company to the extent of the 46 million gallons daily which they assured the Royal Commission they could furnish at any time during the year. These other Companies, however, he would point out, drew their supplies from the Thames, which was very much lower now than it had ever been before. The flow over

Teddington Weir after the Companies had taken their supplies was just slightly above half what it was in June last year. If the Council had been allowed to carry out their water policy ten years ago, the Metropolis would have been in absolute security instead of having a position of affairs which might result in a calamity, though he did not think it would this year. Mr. M'Kinnon Wood said the Government had now taken up the water question, and had assumed the whole responsibility of protecting London against drought. Yet before the ink was well dry on the Government Bill, the Moderates of the Council were coming to tell them that the measure was not sufficient for its purpose. This was the position in which London had been placed by the Government. The amendment was then rejected, and the report received.

LEEDS CORPORATION WATER SUPPLY.

Completion of the Eccup Reservoir Embankment—The Past Year's Working and Profits.

The City Council and the corporate officials of Leeds paid a visit to their water-works last Tuesday; and they ended the day by dining together at the White Hart Hotel, Harrogate. Several speeches were made on the occasion; and from them we cull some interesting information relating to the undertaking. In the first place, it is a pleasure to learn that, after nine years of hard work and constant care and anxiety, the renovation and deepening of the Eccup reservoir embankment has been completed; and the refilling of the huge reservoir has commenced. There has been no subsidence or giving way; and every portion of the work stands firm. When full, the city will have 160 days' supply. The available daily supply, including 6 million gallons a day which the Corporation have power to take from the Wharfe, is 28 million gallons. The present requirements are about 16 million gallons a day; so that there is no immediate anxiety for the future. But during the last ten years, the water requirements of the citizens have increased 50 per cent.; and if the same rate of increase is maintained for the next ten years, the present means of supply will have become exhausted. Already plans for the future are being considered; it being expected that the Corporation will have to look beyond the Washburn Valley for a new source—in fact, it is an open secret that the waters of the River Ure are favourably regarded.

A comparison of the cost of the reservoirs belonging to the Corporation was furnished by the Chairman of the Water Committee (Alderman Cooke); and the following is a summary:—

	Holding Capacity Million Gallons.	Original Cost.	Cost per Million Gallons.
Fewston	866	£151,378	£174 16 0
Swinsty	960	£163,174	£169 19 0
Lindley Wood	750	£199,220	£265 13 0
Eccup	1409	£122,360	£210 0 0
Do. (Reconstruction)	—	£168,106	

From this it is seen that Eccup, including its renovation and deepening, has cost proportionately less than the original outlay on the Lindley Wood reservoir, and not much more than Fewston and Swinsty. By the addition of the second tunnel at Blackmoor, the Eccup reservoir is now available by a greater depth of 3 ft. 6 in., or five days' additional supply. It also appears that the Water Committee have been steadily acquiring land and property in the Washburn Valley. As a consequence, the Corporation have now 35 tenants in the valley, possess 28 farms, two licensed houses, and 714 acres of land, at a cost of £36,714. The annual rent-roll is £1030, or 2¾ per cent. on the purchase cost. Initial steps for further purchases are to be promptly taken.

Regarding the work of the past year, 18 miles of new mains have been laid; making a total of 337 miles, varying from 3 to 42 inches diameter. The increase in the demand for water is shown by the fact that 9929 new supplies have been granted, which is an increase of 1881, as compared with previous years. The total quantity of water sold by meter for trade purposes within the city during the year was 1534 million gallons—an increase of 118 millions over the previous year. The meter supplies outside the city were 90½ million gallons—an increase of 13 millions. The total quantity of water delivered during the year was 5451 million gallons. This includes the townships outside the city boundary; the average daily consumption being 14,936,000 gallons per day. There has been some clamour in the city for free water supplies; but people might just as sensibly ask for free gas. Water is now supplied at half the price the Committee are entitled to charge. They supply free water to all the recreation grounds, public parks, fountains, and for the watering of gardens, cleansing shop and house fronts, passages, yards, horse troughs, and other purposes. This, on a carefully prepared estimate in 1895, shows a loss of revenue to the department of £1600. The city contains 17,596 baths in private houses; and these are all supplied free of cost, although a charge may be made under the Act of 1847. If it were made—5s. per bath per annum—the Committee would obtain an additional income of £4399. Water is also supplied to 51,839 closets, the price charged being from 1s. 6d. to 10s. 8d. per annum. Taking this number at the very reasonable average of 3s. each, a loss of £7500 per annum is realized. The capital cost on the water undertaking is £1,946,656, on which £81,985 has to be paid in interest and sinking fund every year; only leaving by the most careful management an average annual net profit of £12,000. It must be abundantly clear that if this unfair clamour for free water is not steadfastly resisted on all grounds of equity and business principles, then assuredly will follow a rate-in-aid.

Some details were also imparted as to the condition of the Water Committee's finances at the end of the past year. The total income was £123,432, from which had to be deducted £27,894 for working expenses, and £61,121 for interest on loans; leaving a profit of £34,417. After the payment of £20,865 for redemption of debt, there was a surplus profit of £13,552.

THE WATER SUPPLY OF STOCKPORT AND THE DISTRICT.

The Outlying Authorities and the Water-Works.

In the "Gleanings from the Committee-Rooms" in the "JOURNAL" for the 27th ult., we gave an epitome of the proceedings of the House of Lords Committee on the Bill promoted by the Stockport Corporation to enable them to purchase the undertaking of the Stockport District Water Company. The Committee, who were presided over by the Earl of Camperdown, made certain alterations in the Bill, which have been considered at a private meeting of the Council specially convened for the purpose, under the presidency of the Mayor (Mr. T. Webb). A particular interest attached to the conclusions of the meeting from the fact that Alderman Atherton, ex-Mayor, had resigned membership of the Water Purchase Committee of the Corporation rather than consent to the altered conditions; and another member of the Council had publicly protested against the question being considered in private. The alterations to which exception had been taken referred to the terms upon which outside local authorities could withdraw from the undertaking, and the disposition of the surplus profits. Alderman W. Lees, the Chairman of the Water Purchase Committee, informed the Council that, as the result of communication with Lord Morley, the following proviso had been agreed upon as an addition to clause 78: "Provided, however, that in the event of any local authority other than the Urban District Council of New Mills purchasing, under the section of this Act the marginal note of which is 'Sale of Portion of Water Undertaking to other Local Authorities,' the portion of the water undertaking of the Corporation within the district of such local authority, notwithstanding anything in this section contained, any arbitrator or umpire, in determining the price to be paid by such local authority, shall value such portion of the water undertaking as aforesaid as if any such balance as aforesaid were directed to be carried by the Corporation to the district fund instead of being applied in reduction of such water-rate as aforesaid." This proviso would be added to the Bill on the third reading in the House of Lords. Alderman Lees said he deemed the clause with this proviso satisfactory, giving protection to the Corporation against loss in the event of any outside authority seeking to sever themselves from the water undertaking. With regard to the profit clause, although they had not obtained what they asked for, and ought to have had, yet, in view of all the circumstances, and the probability of their not doing better, or even as well, by incurring the expense and trouble of going to Parliament again, he urged that it would be wise for the Corporation to accept the Bill as altered. He moved accordingly: "That this Council do hereby approve of the Stockport Corporation Water Bill, 1899, as amended in Committee of the House of Lords, subject to the further amendments to be proposed upon the third reading in the House of Lords being agreed to by both Houses of Parliament." Alderman F. R. Robinson seconded the motion; quoting figures in support of the view that delay in purchasing would mean a higher price for the undertaking. Alderman Atherton moved, as an amendment: "That, in consequence of the material alterations made by the Special Committee of the House of Lords, it is hereby resolved, unless the Water-Works Company are prepared to accept greatly modified terms as the result of the action of the Lords' Committee, that the Bill be dropped, and the Water Purchase Committee be requested to ascertain as soon as possible what the exact powers of the Corporation are under the Stockport Corporation Act, 1867, and report to the Council at an early date." After a long discussion, the amendment was lost by 23 votes to 11. The original motion was then put and carried.

Gas v. Electric Lighting at Llanrwst.—The District Council of Llanrwst have had before them the question of public lighting. Tenders were submitted for the ensuing year from the local Electricity Supply Company and from the Holyhead and North Wales Gas and Water Corporation. Subject to a contract for three or five years, the former Company offered, under stated conditions, to supply the light for 25s. per lamp per annum. The Corporation undertook to supply gas at 4s. 9d. per 1000 cubic feet net, and emphasized the importance of adopting incandescent gas-burners. The Electricity Company's tender was accepted for 25s. per lamp.

The Chester Corporation's Bill for Gas.—On the submission to the Chester Town Council last Wednesday of the Chief Constable's report regarding his monthly list of the gas supplied in the city, the ex-Mayor (Mr. J. G. Holmes) drew attention to the fact that whereas four years ago, before the introduction of the electric light, the Gas Company's yearly bill against the Corporation was £2389, it had only fallen to £2010 last year—a difference of only £379—notwithstanding the extensive use of the electric light. Mr. R. Lamb explained that, after the termination of the old arrangement with the Company, the latter largely increased the charge per lamp.

Additional Storage for the Llandudno Gas-Works.—At the meeting of the Llandudno District Council last Wednesday, the Gas Engineer (Mr. E. P. Stephenson) submitted a report on the question of the storage accommodation at the gas-works. It showed that the present capacity of the three holders is 190,000 cubic feet, of which one is equal to 160,000 cubic feet. The greatest daily make in 1898 was 250,000 cubic feet; and the Engineer estimates that this year it will be 275,000 cubic feet, and this, with a storage capacity of only 190,000 cubic feet. He recommends an increase, not only because the present capacity is insufficient, but because, all the gas being contained in one holder, if anything were to go wrong with it the works would be crippled. The maximum daily make in 1906 will probably be 536,000 cubic feet; and it is advisable that the total storage capacity should be increased to this amount. For this purpose it would be necessary to construct a holder to contain at least 346,000 cubic feet; but as there is ground available near the present No. 1 holder which would allow of one 120 feet in diameter, the Engineer recommends that a holder in two lifts, 120 and 118 feet in diameter respectively, and 20 feet deep, and having a capacity of 422,000 cubic feet, should be erected. The total holding capacity of the works would then be 612,000 cubic feet. The estimated cost of the new holder would be £8000, and fifteen or eighteen months would be necessary for its completion. The report was adopted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Town Council of Glasgow on Thursday considered the report of the Gas Committee upon the subject of placing stopcocks upon service-pipes. The Committee recommended the adoption of a minute by a Special Sub-Committee, who stated that after considering a report by Mr. Foulis, the Gas Engineer, Mr. Paterson, the Inspector of Lighting, and Mr. Whyte, the Master of Works, they were unanimously of opinion that any benefit likely to accrue to the inhabitants within the area of gas supply from providing stopcocks upon every service-pipe within the area would be far more than counterbalanced by the difficulties in the way of adopting, and the disadvantages which would result from the adoption of, a universal system of the kind. The Sub-Committee agreed further to report that they had been led to this conclusion independently altogether of financial reasons; and that if they had been satisfied that the adoption of such a system of stopcocks was reasonably necessary or expedient, they would have been quite prepared to recommend its adoption, whatever might be the cost of carrying it out. In these circumstances, the Sub-Committee had to recommend that the system which is now and has been in operation since 1892 in connection with this matter be adhered to. Bailie Battersby wished the subject sent back to the Committee. It was brought up, he said, in consequence of four of their employees having lost their lives at a fire; and he considered it their imperative duty to protect life whatever might be the cost. It was pointed out that stopcocks existed in all warehouses and works, and that it was believed that it would be a source of danger to place them upon the services to residential tenements, because there would be great danger to the community when the gas was turned on after it had been shut off. It was also pointed out that, where it was necessary at a fire, a gas-pipe is cut and plugged. This is surely an operation more costly and troublesome than would be a system of stopcocks. But where I would have thought that stopcocks would be of more use than in connection with fires, would be in the case of unoccupied houses, because it is through them that most of the gas poisoning cases arise. It has been resolved, however, in Glasgow, to go on as before; and it cannot be said, as matter of fact, that the absence of stopcocks has led to unpleasant or melancholy results to a degree which calls for a change of system.

The actions in the Court of Session, by the two mechanics from Fifeshire, against the keeper of a temperance hotel in Glasgow, which would have raised some nice questions had they gone to proof, have been nipped in the bud. Lord Kincairney this week held them to be irrelevant, and dismissed them, with expenses.

The Corporation of Paisley had a revenue, last year, in their Gas Department, of £46,294, to which the sale of gas contributed £38,883; ammoniacal liquor and tar, £4173; and coke, £2494. The expenditure amounted to £40,012, of which the manufacture of gas required £32,207; distribution, £3726; rents, rates, and taxes, £2446; and management, £1523. The gross surplus was £6281. Interest and feu duties amounted to £2106; the contribution to sinking fund was £642; to contingent account, £1923; and the amount of deficiency on the electric light account paid was £409. The balance of net profit is £1201, and the sum carried to next account is £6917. The capital account amounts to £134,033. During the year there was repaid £7117 of borrowed money. The sinking fund amounts to £46,100, and the contingent fund to £1989. The accounts were presented to the Corporation on Thursday. It was agreed, in accordance with the vicious system which prevails at Paisley, to appropriate £1000 of the net surplus for the maintenance of public parks, and carry forward the balance of £200. The price of gas was continued at 2s. 6d. per 1000 cubic feet to ordinary consumers; but the charge for gas used in public lamps was raised from 2s. 2d. to 2s. 4d.

At a meeting of the Greenock Police Board on Tuesday, Mr. Mitchell, in moving the adoption of the Gas Committee minutes, said the consumption of gas last year was 281,811,400 cubic feet—4 million cubic feet more than the increase in any previous year. The consumption was still on the increase, and, with the coal-breaking and stoking machinery introduced, they were prepared for a larger consumption. The estimate for the current year is 300 million cubic feet.

The Arbroath Gas Corporation had before them on Wednesday the financial statement for the year ending May 31, 1899, which was submitted by Councillor Sutherland, the Convener of the Finance Committee. The statement showed that the expenditure for the past year, including annuities and interest on loans, had been £12,050, and the revenue £12,066; leaving a balance of £16 as surplus revenue or profit. The increase in the revenue was due to an increased consumption of gas to the extent of 5,593,700 cubic feet; this having been brought about by the introduction of a large number of gas-stoves, gas-engines, and pre-payment meters, and a general increase in the ordinary consumption. The amount spent on material showed an increase of £1067, which was due to more coal having been necessary to produce the extra quantity of gas required, and for lime. As usual, £1400 had been put aside for annuities. The profit derived from manufacturing residual products at the gas-works had amounted to £859, as against £976 for the previous year; showing a decrease of £117. This was owing to a fall in the price of naphtha and boiled tar. The sum of £245 had been paid to the Harbour Trustees, under the Arbroath Harbour subvention scheme. The property account had been increased by the sum of £1288, being the price paid for new meters, for prepayment meters, and for new pipes laid; £50 paid to the Parliamentary Agents for carrying through the Provisional Order to supply electricity; and £200 also paid to the Parliamentary Agents for promoting the Gas Bill. The latter two sums, however, in terms of a resolution of the Finance Committee, are to be removed from the property account and placed to the suspense account. The amount in the bank at the close of the year was £3654. The accounts were approved of; and Mr. Sutherland was awarded a vote of thanks. The report by Mr. R. S. Carlow, the Engineer and Manager, which is always put in an interesting way, was as follows: The quantity of coals used during the year was 6623 tons, as against 5865 tons in 1897-98; being an increase of 758 tons, or 12·92 per cent. This has produced 62,887,900 cubic feet of gas, as against 57,294,200 cubic feet the previous year, which is an increased make of 5,593,700 cubic feet, or 8·90 per cent. In the past year the make has been 9495 cubic feet, which is a decrease of 273 cubic feet per ton, or 2·77 per cent.; and the gas sold has been 8452 cubic feet, which is a decrease of 312 cubic feet, or 3·56 per cent. The unaccounted-for gas for the year

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 227.

Issue.	Share.	When a Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 13	10½	Alliance & Dublin 10 p. c.	21¼—22¼	..	4 13 4
100,000	10	,,	7½	Do. 7 p. c.	15¼—16½	..	4 10 11
800,000	100	July 3	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	May 12	6	Bombay, Ltd.	6¼—6¾	..	4 8 11
40,000	5	,,	6	Do. New, £4 paid	4¼—4¾	..	5 1 1
880,000	Stk.	Feb. 24	12	Brentford Consolidated	275—280	..	4 5 9
240,000	,,	,,	9	Do. New	215—220	..	4 1 10
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	June 15	4	Do. 4 p. c. Deb.	126—130	..	3 1 7
220,000	Stk.	Mar. 29	11½	Brighton & Hove Orig.	260—270	−2½	4 5 2
226,320	,,	,,	8½	Do. A. Ord. Stk.	194—197	..	4 6 4
973,500	Stk.	Feb. 24	5	Bristol, 5 p. c. max.	135—130	..	3 16 11
420,000	20	Mar. 29	10	British	45—47	..	4 5 1
50,000	10	Feb. 24	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	,,	9	Do. 7 p. c.	20—22	..	4 1 10
500,000	10	Apl. 27	6	Buenos Ayres (New) Ltd.	10—10½	..	5 14 3
220,000	Stk.	June 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
150,000	20	July 13	8½	Cagliari, Ltd.	28—29*	..	5 13 10
100,000	10	June 1	7½	Cape Town & Dis., Ltd.	13—14	..	5 7 2
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Apl. 13	15½	Commercial Old Stock	316—321	..	4 4 1
200,750	,,	,,	10½	Do. New do.	245—250	..	4 4 0
200,750	,,	June 15	4½	Do. 4½ p.c. Deb.	143—148	..	3 0 10
800,000	Stk.	June 15	10	Continental Union, Ltd.	187—192	..	5 4 2
200,000	,,	,,	7	Do. 7 p. c. Pref.	182—187	..	3 14 10
51,600	Stk	Feb. 24	14	Croydon A 10 p. c.	—	—	—
168,400	,,	,,	11	Do. B 7 p. c.	—	—	—
555,000	Stk.	Feb. 24	5½	Crystal Palace Ord. 5 p c.	125—140	..	3 15 0
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	Jan. 27	11	European, Ltd.	23—24	..	4 11 8
354,060	10	,,	11	Do. £7 10s. paid	17—18	..	4 11 9
14,993,075	Stk.	Feb. 10	4⅝	Gas-light and Coke Ord.	109—112	+5½	4 7 5
2,400,000	,,	,,	3⅝	Do. 8½ p. c. max.	96—103	+1½	3 10 0
3,799,735	,,	,,	4	Do. 4 p. c. Con. Pref.	126—128	..	3 2 6
3 843,975	,,	June 15	3	Coke 3 p. c. Con. Deb.	99—101	..	2 19 5
70,000	10	May 31	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	May 12	10	Imperial Continental	225—230	..	4 6 11
473,600	Stk.	Feb. 10	3½	Do. 3½ p. c. Deb. Red.	102—105	..	3 6 8
75,000	5	June 15	6	Malta & Medn., Ltd.	5—5⅛	..	5 9 1
560,000	100	Apl. 4	5	Met. of 5 p. c. Deb.	112—114	..	4 7 9
250,000	100	,,	4½	Melbourne 4½ p. c. Deb.	110—112	..	4 0 4
541,920	20	May 31	5	Monte Video, Ltd.	13—14	..	7 2 11
617,946	Stk.	Feb. 24	9½	Newc'tle & Gatesh'd Con.	228—233	..	3 19 5
264,855	Stk.	June 29	8½	Do. 8½ p. c. Deb.	106—109	..	3 4 8
					* Ex div.		

Issue.	Share.	When a Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	May 31	8	Oriental, Ltd.	7¼—8	..	5 0 0
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—7	..	5 14 3
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1¾	..	4 11 5
60,000	5	Mar. 29	7	Ottoman, Ltd.	5½—6	..	5 16 8
500,000	100	June 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	11½—12	+¼	5 16 8
250,000	Stk.	June 29	4	Do. 4 p. c. Deb.	101—103	..	3 17 8
250,000	10	Mar. 29	10	San Paulo, Ltd.	17—18	..	5 11 1
135,000	Stk.	Mar. 29	10	Sheffield A.	244—249	..	4 0 4
209,053	,,	,,	10	Do. B.	244—249	..	4 0 4
447,427	,,	,,	10	Do. C.	244—249	..	4 0 4
5,600,000	Stk.	Feb. 10	5½	South Metrop., 4 p.c. Ord.	135—140	..	3 16 2
1,460,000	,,	July 13	3	Do. 3 p. c. Deb.	100—102*	..	2 18 10
120,000	Stk.	—	6	Tottenham A. 5 p c. and B. 5½ p.c.	143—145	..	4 2 9
250,520	,,	—	4½		103—105	..	4 5 9
55,100	,,	—	4	Edmonton 4 p.c. Deb.	115—120	..	8 6 8
182,380	10	June 15	5	Tuscan, Ltd.	9—10	..	5 0 0
149,900	10	July 3	5	Do. 5 p. c. Deb. Red.	98—100	..	5 0 0
				WATER COMPANIES.			
746,184	Stk.	June 29	11	Chelsea, Ord.	315—320	..	3 8 9
150,000	,,	,,	5	Do. 5 p. c. Pref.	167—170	..	2 18 10
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	148—153	..	2 18 10
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	155—160	..	2 16 3
1,720,560	Stk.	Apl. 13	7	East London, Ord.	214—219	−3½	3 3 11
654,740	,,	June 29	4½	Do. 4½ p. c. Deb.	155—158	..	2 17 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
700,000	50	June 15	7½	Grand Junction 10 p. c. max. 4 p. c. Deb.	111—114	..	3 5 9
310,000	Stk.	Mar. 29	4		135—140	..	2 17 2
708,000	Stk.	Feb. 10	14	Kent	360—365	..	3 16 9
160,000	,,	,,	7	Do. New, 7 p. c. max.	210—215	..	3 5 1
1,043,800	100	June 29	10½	Lambeth, 10 p. c. max.	298—303	..	3 9 4
406,200	100	,,	8	Do. 7½ p. c. max.	225—230	..	3 9 7
850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	135—140	..	2 17 2
500,000	100	Feb. 11	13¾	New River, New Shares	430—435	..	3 3 3
1,000,000	Stk.	Jan. 27	4	Do. 4 p. c. Deb.	137—142	..	2 16 8
902,300	Stk.	June 15	7½	South-wark Ord.	204—209	..	3 11 9
126,500	100	,,	7½		193—198	..	3 15 9
489,200	Stk.	,,	5	and 5 p. c. Pref.	167—172	..	2 18 2
1,019,585	,,	Apl. 13	4	Vauxhall 4 p. c. A Deb.	135—140	..	2 17 2
1,155,066	Stk.	June 15	10	West Middlesex	295—305	..	3 5 7
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	154—158	..	2 17 0
200,000	,,	Mar. 10	8	Do. 8 p. c. Deb.	102—104	..	2 17 8
					* Ex. div.		

1897-98 was 8·73 per cent. of the quantity made; this year it is 9·53, which is an increase of 0·80 per cent. The illuminating power of the gas supplied to consumers has during the year averaged 25·50 candles. The number of consumers for the year ending May, 1898, was 5456; for the past year the number was 5759, or an increase of 303. There have been 690 meters given out from the works during the year, 330 of which were new, 245 of these being prepayment meters and 360 repaired, and 59 new service pipes have been laid. Mr. Keith stated that they required to contract for 6600 tons of coal for the current year; but as they had 2700 tons in hand, the Committee had resolved not to contract for more than 4000 tons in the meantime. This year coal was upwards of 2s. per ton dearer than it was last year. Taking into consideration the 2700 tons which they had in hand, they would still have to make up £496 on account of the increased price of coal. The recommendations of the Committee were adopted.

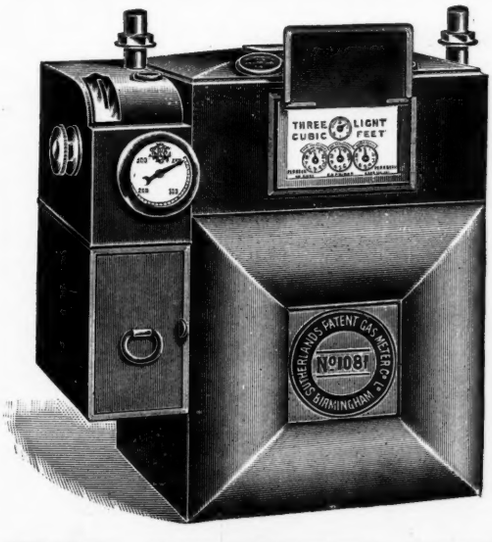
The annual meeting of the Montrose Gaslight Company was held on Wednesday. The report by Mr. T. Douglas Hall, the Manager, showed that the gas manufactured during the year ending June 30 amounted to 30,772,000 cubic feet; being an increase of 875,000 feet. The coal carbonized was 2800 tons; and the average quantity of gas per ton had been 10,838 feet. The consumers at the close of the year numbered upwards of 2300, being 60 more than in previous years. The average illuminating power had been about 25 candles. The works and plant were reported to be in an efficient state. The balance-sheet prepared by Mr. A. M. Watt, Secretary, showed that the gross income had been £6111, and the expenditure, including deterioration, £4684; leaving a surplus of £1427. The Directors recommended the payment of a dividend of 50s. per share, amounting to £1250, leaving £177 to be carried forward. The Chairman, in referring to the different items in the report and the balance-sheet, specially alluded to the increase in the quantity of gas manufactured, and in the number of consumers, and expressed regret that so few consumers had availed themselves of cookers. On this subject, he pointed out the benefits of cooking by gas—that for a few shillings per annum cookers suitable for families of five, six, eight, and ten could be rented from the Company. The report, balance-sheet, and the Directors' recommendations were all unanimously adopted.

The Selkirk Gaslight Company is one of the most prosperous in the country. At the annual meeting of the shareholders on Monday, the Directors reported that they had pleasure in submitting a statement of affairs and balance-sheet which showed a very favourable and gratifying result on the year's working. The total make of gas during the past year was 22,383,600 cubic feet—an increase of more than 3½ millions upon the previous year. The quantity of gas sold or accounted for was 20,566,100 cubic feet. The quantity of coal used was 2170 tons, giving a yield of about 10,300 cubic feet of gas per ton. For the current year, contracts have again been made on what the Directors consider very favourable terms. The use of cookers, gas-fires, and other appliances has greatly exceeded the expectations of the Directors; and to this cause they in a great measure attributed the large increase in the consumption of gas. The revenue amounted to £4154, of which £3379 was derived from the sale of gas, £196 from sales of tar and liquor, £275 from coke, and £29 from spent lime. The expenditure was £2769, of which £1756 was for coal, lime, and carriage. There was thus a gross profit of £1385. Out of this sum, a dividend was paid at the rate of 10 per cent., absorbing £453; to depreciation there was carried £250, raising the depreciation fund to £4914; and the balance of £682 has been added to the surplus fund—making it now £12,219. These two funds are a peculiar feature of the Company's position. Together they amount to £17,133. The total value of the gas-works is £17,601; and thus the Company have funds in their books which nearly equal the value of their property. I imagine, however, that the funds do not exist in cash, but have been, for the most part, put into the works, from time to time, by which means the Company have been able to keep down their capital account. Whichever way it be, the state of the funds shows that a highly prosperous business has been conducted. I observe that during the year 508,600 cubic feet of gas was sold through slot meters. The leakage was under 8 per cent. These circumstances, and the works being in good order, have enabled the Company to reduce the price of gas from 3s. 6½d. to 3s. 1½d. per 1000 cubic feet. This price is the lowest in the district, and is very highly creditable to the management. The Company are of the same opinion, for on Monday they voted their Manager (Mr. W. B. M'Lusky) an increase of salary by £20 per annum, and also presented him with a cheque for £20 for past services.

The Corporation of Aberdeen have had the misfortune this week to lose the services of their Gas Convener—Mr. W. Johnston. Mr. Johnston has held the office for nearly five years, and has performed the duties with acceptance. His retirement has not been brought about by anything directly connected with the gas undertaking, but has arisen out of the arrangements for the chartering of a steamship to carry the coal for the gas-works into the port of Aberdeen. The vessel had been secured; but there remained the question of who was to discharge her cargo. Offers for the work were sought and obtained; and it was in the discussion of these that the friction arose. The offers varied from 9½d. to 8d. per ton. Mr. Johnston's attitude was that the person who offered to do it for 8d. would not be able to pay his men the standard rate of wages, which is 8½d. per ton. He preferred that, in the circumstances, they should not seek a contractor, but should have the work done by men in the employ of the Council, under the supervision of Mr. Alex. Smith, the Gas Engineer. I certainly would have thought this to be the best arrangement; but the Gas Committee thought otherwise, and adopted the offer of 8d. Thereupon Mr. Johnston sent in his resignation as a member of the Committee. The Town Council on Wednesday, by a majority, adopted the recommendation of the Gas Committee. Mr. Johnston was thereafter urged to remain on the Committee and see the matter through, which he had begun; but he declined, after the vote. He would not, he said, take the responsibility of the trouble that was likely to arise in the working out of so small an offer. The resignation is to be considered at the next meeting of the Council.

The Berwick and Tweedmouth Gaslight Company, Limited, held their annual meeting on Wednesday. It was reported that the income for the year was £5936, of which £5148 was derived from the sale of gas; £130 from meter-rents; and £658 from sales of coke, tar, and lime. The total

SUTHERLAND'S
PATENT
PREPAYMENT GAS-METERS



SPECIAL FEATURES:

Accuracy of Measurement.

Simplicity of Construction.

Excellency of Workmanship and Material.

EVERY METER GUARANTEED.

THE SUTHERLAND GAS-METER COMPANY,
ESSEX WORKS, BIRMINGHAM.

expenditure was £4761, of which £2794 was upon coal. The balance of profit was £1175. A dividend at the rate of 10 per cent. was declared, absorbing £1086.

It is no uncommon matter to read a letter, almost always anonymous, in a newspaper, wanting to know why the price of gas in a certain town is higher than it is in some other town. Such a letter appeared in the "Glasgow Evening News" a week or two ago, with reference to the price of gas in Glasgow. Like many others of the same sort, it would have received no notice here, but the development obliges me to take it up. An editorial note followed a few days afterwards, in which a comparison was made of the prices of gas in Glasgow and Widnes. Then, on the 14th inst., another anonymous writer set up the contention that while Widnes no doubt claimed the world's record, so far as a minimum price was concerned, which, up to the present was 2s. 10d., 2s. 4d., 1s. 10d., 1s. 8d., 1s. 6d., and 1s. 4d. for gas of 16 or 18 candles, Glasgow gas of 21 candles, at 2s. 2d. for all purposes, or 1¼d. per candle, was among the cheapest in Great Britain, or in the universe. He then went on to state that, in comparing the differential rates for gas at Widnes, and considering that 40 per cent. of the meters in use were on the slot principle (none being used in Glasgow), for which at least 20 per cent. above the minimum price was paid for the gas, he was confident that a fair analysis of accounts would show that Glasgow was supplying gas at much the same rate as Widnes. Further than that, he dragged in Hamilton, which he made out to have the cheapest gas in the world —Glasgow and Widnes being a good second. The price at Hamilton is 2s. 1d. per 1000 cubic feet, or practically 1d. per candle; and there is a promise of a substantial reduction at an early date. On the 18th inst., Mr. Isaac Carr, writing in the same newspaper, complained that the bald statement of his selling prices was scarcely fair, because the higher figures were for small sales beyond the borough boundary—so small that they had practically no effect on the aggregate gas-rental. The quantity sold at these prices was 4 per cent. of the total consumption, and the money received amounted to ¼d. per 1000 cubic feet on the total sales. Therefore the price of gas in Widnes, with the recent reduction, would be 1s. 3d. and 1s. 5d. within the borough, and the actual average receipts throughout the whole district of supply would be 1s. 4¼d. per 1000 cubic feet. The number of slot meters in use is 60 per cent., and not 40 per cent.; and these meters pass 15·3 per cent. of the total sales. The slot-meter consumers do not pay 20 per cent. more for their gas than ordinary consumers; on the contrary, they pay precisely the same price, *plus* interest and depreciation on the cost of internal pipes and fittings, grillers, and meters, which are supplied free, together with the extra cost of collection. Then Mr. Carr went on to say that he had no idea what the cost of the production of gas at Hamilton was; but, taking the figures from "Field's Analysis," he found that the comparative cost of production at Glasgow and Widnes was: At Widnes, 13·851d., less 8·668d. received for residuals = 5·183d.; distribution charges, 1·281d.; total cost of manufacture, maintenance, and distribution, 6·464d. At Glasgow the cost of production is 21·780d., less 5·850d. received for residuals = 15·930d.; distribution charges, 2·210d.; total cost of manufacture, maintenance, and distribution, 18·140d. Then he allows to Glasgow, in respect of a difference of 3 candles in illuminating power, at 1d. per candle, 3·000d.; thereby reducing the total cost at Glasgow to 15·140d. per 1000 cubic feet, or 134 per cent. higher than at Widnes. The total cost at Widnes, including standing and all other charges, is 12·213d. per 1000 cubic feet, from which it would be seen that the Widnes Corporation are now in a position to sell gas at 1s. 1d. per 1000 cubic feet throughout their district of supply, were it not for the large sums appropriated for the relief of the general district rates and increasing the sinking fund beyond the requirements of the Act. He concludes with the remark that the comparative figures for Hamilton would, at this juncture, probably prove of interest. Doubtless they would; but as yet Mr. Ewing, of Hamilton, has not taken up the challenge. As a small contribution to the discussion, I may point out that at Hamilton the price is 25d. for 24-candle gas, with no meter-rents. At Widnes the receipts, over all, amount to 16½d. for 18-candle gas, with meter-rents varying from 1s. 4d. for a two-light meter to £4 for a 400-light meter. There is thus not much difference between the amounts which the people in the two places pay for gas. When the extra cost of coal to produce the higher quality gas is taken into account, the better performance is that of Mr. Ewing.

Applications from four workers of the Glasgow Gas Trust, who have been in the service 56, 46, 35, and 31 years respectively, for assistance have been considered by Messrs. R. M. Mitchell and Willock, who have recommended allowances of 20s., 14s., 12s., and 12s. per week; also a donation of £10 to the widow of a worker for 40 years at the Dalmarnock station; and one of £100 to the widow of Mr. A. Duncan, for 16 years the Chief Chemist at the Dawsholm works.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 22.

Sulphate of Ammonia.—A quiet market has again to be recorded, and a further slight decline in values; the closing quotations being £12 1s. 3d. to £12 3s. 9d. per ton, delivered f.o.b. at the ports. The larger makes continue for the most part to be delivered on contracts made in advance; but other available supplies have been sufficient to meet the limited demand being experienced. For August-September delivery, spot prices are being quoted; but buyers will not operate in this position unless at some discount. Further ahead, £12 per ton continues to be quoted by makers; but speculators are offering abroad at less money, without, however, attracting much interest.

Nitrate of Soda is quiet at 7s. 7½d. per cwt. for fine quality on spot.

LONDON, *July* 22.

Tar Products.—Although little actual business is being done in pitch for early delivery, the quotations for forward are better than for prompt; but this to a considerable extent is nominal. Benzol appears to have fallen flat again; and, excepting for special qualities, the price is not much above the bottom touched. The large and increasing quantity

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

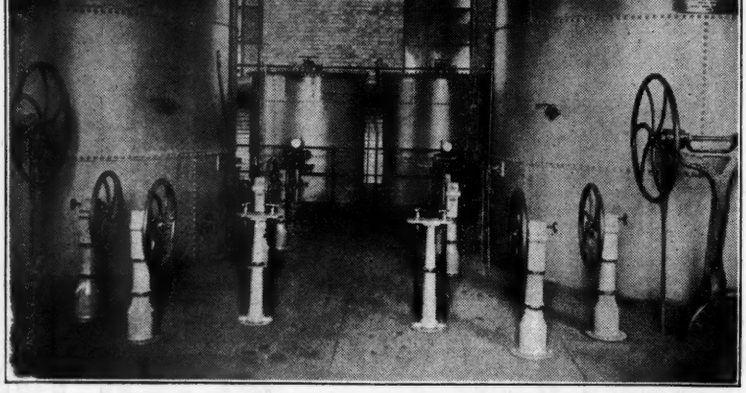
The Economical Gas Apparatus Construction Co., Ld.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

CARBURETTED WATER-GAS ENGINEERS.

THE M.-W.-P. PLANT is designed to use the Heaviest as well as the Lightest Grade of Oil.



RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.
The Maximum Daily Capacity of the Birmingham Corporation's Plant, which was erected by this Company, is 10 MILLION CUBIC FEET.

roduced by the Continental and English coke-oven plants is a factor which, in the absence of any important increase in consumption, tends to keep the price low. Carbolic keeps steady, but exhibits no great life. Creosote and other oils are in fair demand, without much alteration in price. Anthracene is flat, with very few inquiries.

Average prices are: Tar, 15s. 6d. to 25s. Pitch, east coast 30s., west coast 27s. Benzol, 90's 7½d.; 50's 8¼d. Toluol, 1s. 2d. Solvent naphtha, 1s. 1d. Heavy naphtha, 1s. Crude, 30 per cent., naphtha, 3¼d. Creosote, 3¼d. Heavy oils, 62s. 6d. Carbolic acid, 60's, 2s. 1d. 75's 2s. 8d. Creosote salts, 47s. 6d. Anthracene, "A" 3½d. to 4d.; "B" 2½d. to 3d.

Sulphate of Ammonia is flat at £11 17s. 6d. to £12, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—In the coal trade of this district, there is a good demand for most descriptions of fuel, with prices well maintained. The only qualities that are not moving away freely are the better sorts, for house-fire purposes. With pits running four to five days, there is some accumulation of stock; but this will be fully needed for the ensuing winter's requirements. Local collieries hold firmly to recent rates, notwithstanding competition of cheaper lots from other districts. The lower descriptions of round coal meet with a ready sale; and supplies are not more than equal to requirements, with prices strong on the recent basis. The shipping demand for steam coal is showing some improvement, with a hardening tendency in selling rates. Engine fuel is in brisk request; and with the restriction of the production of slack caused by the shorter time now being worked at many of the house-coal pits, collieries are finding it increasingly difficult to satisfy customers' wants, with the result that prices continue to stiffen up—an advance of 3d. per ton being generally quoted on forward contracts. Coke is still in a strong position, with the recent advance well maintained. At the pit, best Wigan Arley averages 11s. 6d. to 12s. 6d. per ton, Pemberton four-feet and seconds Arley 10s. to 11s., common house coal 9s. to 9s. 6d., steam and forge coals 8s. 9d. to 9s., and engine fuel 6s. 6d. to 6s. 9d. for best, 5s. 6d. to 5s. 9d. for medium, and 4s. 9d. to 5s. for common slack. Delivered at the Garston Docks, steam coal is fetching 9s. 6d. to 9s. 9d. per ton; at the High Level, Liverpool, 10s. to 10s. 3d.; and at the Partington tips of the Manchester Ship Canal, 10s. 3d.

Northern Coal Trade.—There is a steady demand for coals, especially for steam coals; and the prices seem to be generally firmer. Best Northumbrian steam coals are 12s. 6d. per ton, f.o.b.; second class steam are 11s. 9d. per ton, and steam smalls are 6s. per ton. The demand is rather larger for bunker coals; and the price is now about 9s. 6d. per ton f.o.b. for good unscreened qualities. There is little or no alteration in the manufacturing coal trade; but household coals are dull and in limited consumption. In the gas coal trade there is a rather better demand; and the quantities that are sent by sea are beginning to be increased, so that the collieries are working fully. The advance in the wages of the miners of Durham just granted will tend to further stiffen the price of coals. Best Durham gas coals are quoted at from 9s. 6d. to 10s. per ton f.o.b.; and for some small quantities, the higher of these two prices is believed to have been paid. Gas coke is steady, and the quotation is now 13s. 6d. per ton f.o.b. in the Tyne; the stocks being only very small at present.

Scotch Coal Trade.—The miners being for the most part on holiday, trade was almost at a standstill last week; and no change can be reported in prices. The shipments for the week amounted to 183,697 tons—a decrease upon the preceding week of 11,991 tons, and upon the corresponding week of last year of 45,436 tons. For the year to date, the total shipments have been 4,574,417 tons—a decrease upon the corresponding period of last year of 265,047 tons.

The Godalming Corporation and the Water-Works.—After a prolonged discussion, the Godalming Town Council resolved, on Monday last week, by 14 votes to 7, to purchase the undertaking of the Frith Hill, Godalming, and District Water Company for £72,250. It was stated that a rate-in-aid will probably be required for about eight years.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Wednesday, Messrs. Edwin Fox and Bousfield sold parts of freehold Adventurers' shares in the New River at the rate of £120,000 per share, and parts of freehold King's shares at the rate of £115,500 per share; also 3 per cent. debenture stock at 104 per cent., and new shares of £100 paid at £435 *ex div.* Some 6 per cent. £12 10s. preference shares in the Salisbury Gas Company were sold recently at from £14 10s. to £15 2s. 6d. each; some 7 per cent. shares fetching £16 5s. apiece. Two £25 debentures (5 per cent.) in the same Company fetched £28 2s. 6d. and £28 10s. each; and a 4 per cent. debenture of the same nominal value was sold for £26. Five £10 ordinary shares in the Fisherton Water Company were bought at £19 10s. each. Last Friday, Mr. C. V. W. Martin sold by auction, at the Bull Hotel, Wakefield, some £5 shares in the Wakefield Gas Company, earning 11½ per cent., for £13 10s. each; also 43 "B" 5th shares of £5 each, on which 9 per cent. is being paid, for £10 10s. each; some original £25 shares for £66 and £66 15s. each; and 150 shares of £10 each (£4 paid) for £10 5s. each. Some £10 shares earning 8½ per cent. were secured at £19 15s. apiece. Five £10 shares in the Wigton Gas Company were lately sold for £15 12s. 6d. each. A few original shares in the Kildwick Gas Company were sold last Thursday at Bradford for £15 5s. each. At the George Hotel, Bedford, last Friday, Messrs. Stafford and Rogers obtained high prices for £360 of old stock and £240 of new stock of the Bedford Gas Company. The highest price realized for the former was at the rate of £316 13s. 4d. per cent., and the lowest £300 per cent.; for the latter, the highest price was at the rate of £240 per cent., and the lowest £228 per cent. Two other lots of new stock were also sold, reaching £242 6s. 8d. per cent. These figures are considerably in advance of those realized at the last sale held by the same firm, in February, which were at that time considered most satisfactory. The highest prices then obtained being at the rate of £280 per cent. for the old, and £214 5s. for the new stock.

C. & W. WALKER, LTD.,

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE.

110, CANNON STREET, LONDON.

Telegraphic Addresses: "Fortress, Donnington, Salop;" "Fortress, London."
Codes Used: A.B.C. and A1.

GASHOLDERS

GADD & MASON'S SPIRAL-GUIDED HOLDERS.

PURIFIERS. VALVES. SCRUBBERS.

PURIFYING-MACHINES FOR REMOVING AMMONIA.

Carbonic Acid and Tar Extracting Washers.

SULPHATE OF AMMONIA PLANT.

CLAUS' PATENT SULPHUR-RECOVERY PLANT.

SELF-SEALING RETORT-MOUTHPIECES. LIFTING APPARATUS. CENTRE & FOUR-WAY VALVES.

MAKERS OF WECK'S PATENT CENTRE-VALVE.

TAR-DISTILLING PLANT. CONDENSERS. WOOD SIEVES.

TAR-BURNERS. ROOFS. GIRDERS, &c., &c.

Makers of Cripps' Patent Grid Valve and Hydraulic Main Valve.
Makers of Holgate's Patent Gas-Purifying Plant.
Makers of Tysoe's Patent Self-Sealing Mouthpiece.

The Skipton District Council and the Gas-Works.—The Skipton District Council have given notice of their intention to purchase the Gas Company's undertaking at a given price or by arbitration.

Hunstanton Gas Profits.—The Hunstanton District Council do not make a large amount of profit out of their gas and water undertakings. Last year the net profit on the gas undertaking was only £292, and on the water-works £15. Yet the Chairman of the Committee proposes, at the next meeting of the Council, to ask the members to consider the advisability of decreasing the charge to the gas consumers, so as to give them the benefit of the prosperity of the Council's purchase. This is as things should be.

Broadstairs Gas and Water Supply.—For some time past, considerable discontent has existed in Broadstairs and district with the supply of water given by the Broadstairs Water Company. The matter has now culminated in the appointment by the District Council of Mr. W. A. M'Intosh Valon as Consulting Engineer to report upon the whole question—the advisability of purchasing the works, or otherwise, being postponed until after the receipt of his report. The District Council are also unanimous with regard to the desirability of purchasing the gas-works. It is probable therefore that a Bill may be promoted next session for the purchase of both undertakings.

Manchester Gas-Works Profits.—It was announced at the meeting of the Manchester Corporation Gas Committee last Wednesday that the income of the department for the past financial year amounted to £594,970; and after the necessary amounts had been paid into the sinking fund, &c., there would remain a net profit of £74,052. From this amount, the Committee intended to hand over £51,000 in relief of the rates. There had been an increase of 3990 users of prepayment gas-meters, while as compared with last year, there was an increase of £41,328 in connection with gas cookers and appliances. The number of gas consumers had increased by 6695; and there had been a further 20,000 tons of coal used in the manufacture of gas.

C. & W. Walker, Limited.—The statutory meeting of this Company was held last Thursday, at the Royal Victoria Hotel, Newport, Salop. In the unavoidable absence of the Chairman, Mr. J. F. Wright, the chair was taken by Mr. W. Perrott. The Secretary (Mr. W. Cottrell) having read the notice convening the meeting, the Chairman stated that this was merely a statutory meeting, and there was practically no business to communicate to the shareholders. He, however, had pleasure in stating that the ordinary shares of the Company had been subscribed fully four times over; and the whole of the shares about three times over. All the shares had been duly allotted; and the certificates were now being prepared and would be issued as soon as possible. The works were full of orders for many months to come; and everything was progressing in a highly satisfactory manner. He concluded by stating that he or the Managing Director (Mr. Alfred Featherstone) would be pleased to answer any questions. No questions were, however, asked; and, with a few remarks from Mr. Featherstone bearing out the statements of the Chairman as to the works being full of orders and every department in full swing, the meeting closed.

Penny-in-the-Slot Machines are, according to the Deputy Master of the Mint, responsible for withdrawing from general circulation, in London alone, bronze coins to the estimated value of £40,000.

The Costs of the Ilford Gas Bill.—The Ilford District Council have lately had presented to them the bill of costs, amounting to £4350, in connection with their parliamentary proceedings this session, as reported at length in the "JOURNAL."

Hoylake and West Kirby Gas and Water Company, Limited.—The report of the Directors of this Company for the year ending the 30th of June, which will be presented at the ordinary general meeting on the 2nd prox., shows that a total of £3681 is available for distribution; being £1896 on the gas, and £1785 on the water portion of the business. Out of the £1896, the Directors recommend dividends amounting to £1637, and out of the £1785, dividends amounting to £1630; making together £3267, and leaving a balance of £414. The dividends are at the rates of 13 and 10 per cent. per annum on the gas capital, and at 10 and 7 per cent. on the water capital. The Company sold 34,163,406 cubic feet of gas for public and private consumption in the past year, at the close of which there were 1020 meters, of which 189 were prepayment, and 175 stoves in use. The number of premises supplied with water was 2102.

Reductions in Price.—The Hoylake and West Kirby Gas and Water Company, Limited, announce that, from the date of recording the meter-indices for the quarter ending the 30th of June, the price of gas supplied through ordinary meters was reduced to 3s. 6d. per 1000 cubic feet net for all purposes. This is a concession of 2d. The Gas Committee of the Market Harborough District Council have decided that the following are to be the charges for gas in their district: Under 15,000 cubic feet per quarter, 3s. 1½d. per 1000 cubic feet; under 65,000 cubic feet, 3s. 1d.; under 120,000 cubic feet, 3s.; under 250,000 cubic feet, 2s. 11d.; under 400,000 cubic feet, 2s. 10d.; under 500,000 cubic feet, 2s. 9d.; under 650,000 cubic feet, 2s. 8d.; above this quantity, 2s. 7d.—in all cases with a discount of 2½ per cent. for payment within a month. The Gas Committee of the Stalybridge Corporation have decided to reduce the price 3d. per 1000 cubic feet; bringing it down to 2s. 3d.

The Leeds Pipe-Layers and the Eight-Hour Day.—The men in the pipe-laying department of the Leeds Corporation Gas Committee recently applied for an eight-hour day; and it was granted by the Committee "on condition that the men commence work at the Dewsbury Road works, or elsewhere, at 7.45 a.m., with one hour for dinner, and finish at 5.30 p.m."—walking time or conveyance being allowed for the distance travelled beyond the radius of 1¼ miles from the Town Hall. The men discussed the conditions at a meeting held on the 16th inst., at which the District Secretary of the Union (Mr. J. E. Smith) and the District Organizer (Mr. Walter Wood) were present. Various opinions were expressed on the Committee's resolution, and some of the men seemed to detect a threatened encroachment on their privileges in the expression "or elsewhere." Generally speaking, however, a conciliatory tone was adopted by the more experienced; but it was eventually decided to take a ballot on the new arrangement.

R. & A. MAIN, Ltd.

Argyle Works, GLASGOW. 214-226, St. John Street, Clerkenwell Green, LONDON, E.C.

Telegrams: "GASMAIN, GLASGOW." Telegrams: "GASMAIN, LONDON."

BRISTOL: 28, BATH STREET. Telegraphic Address: "GOTHIC."

BIRMINGHAM: 1, OOZELLS STREET. Telegraphic Address: "GOTHIC."

MANCHESTER: 87, BLACKFRIARS STREET. Telegraphic Address: "GOTHIC."

THE

"Main" Cooker,

With Enamelled Grids and Shelf Guides.

SEVERAL COLOURS OF ENAMELLED LININGS.

Prices from - - £4 12s. 6d.

NEW SEASON'S LIST NOW READY.

Sale of the Melbourn Gas-Works.—The small Company supplying Melbourn, in Cambridgeshire, with gas is in liquidation; and last Wednesday the works were sold by auction by Mr. Challis (of Messrs. Challis and Co., of Sawston), at Royston, for £385; the purchaser being Mr. E. N. Hope, of Meldreth. The works, which are freehold, comprise a small complete manufacturing plant, with manager's house, mains, public lamps, meters, &c.; and they originally cost about £2000. The present price of gas is 7s. per 1000 cubic feet; but the new proprietor intends to reduce this as soon as practicable.

Accidental Poisoning by Coal Gas.—Dr. Danford Thomas held an inquest last Friday, at the New Providence Hall, Edgware Road, on the body of Jessica Margaret De Vernet, a teacher of singing, who died at No. 20, Aldridge Road Villas, Westbourne Park, from the effects of gas poisoning. She had only just entered on the occupation of the premises, and a gas-fitter had been employed to shift some chandeliers. This work was not completed, and the pipe from the gas-meter to a front room was left unplugged. Someone subsequently turned on the gas at the meter, forgetting or being in ignorance of the unfinished work in the front room. The escaped gas filled the room in which the deceased was sleeping; and she was found dead in bed on Wednesday afternoon. The Jury expressed the opinion that someone was to blame; but, upon the evidence, they could not fix it with certainty. They returned a verdict of "Death by Misadventure."

The Singapore Municipality and the Gas-Works.—Our readers may remember that at the last meeting of the Singapore Gas Company reference was made to the subject of the suggested acquisition of the Company's undertaking by the Municipality. The Company agreed to accept £55,000 for it; the stock and other assets being taken at a valuation. At the meeting of the Municipal Commission on the 21st ult., the President (Mr. A. Gentle) stated that the proposal had been put before the Government, and the Governor had consented to the Commissioners making the Company an offer not exceeding $300,000 for their property. This figure had, he said, been based upon the report of their Engineer (Mr. Moulsdale), who had examined the mains, plant, &c. He also stated that just before the meeting he had received a letter from the Manager of the Gas Company (Mr. A. Ford) to the effect that the Directors had resolved not to accept less than £55,000—one of the largest shareholders desiring to make the price £65,000, as he considered the concern well worth this figure. One could not be surprised that the Company were inclined to ask £65,000, after the reports they had received from Singapore. They had a very clever Manager there; and his accounts, no doubt, were satisfactory. The Municipality's offer, however, was based upon the report he had mentioned. He therefore moved that a letter be addressed to the Manager, making a formal offer of $300,000 for the plant, works, business, and goodwill of the Company; payment to be by debentures secured on the rates and taxes of the Corporation, and redeemable at such periods, and bearing such interest, as might be agreed upon. Also that he be requested to communicate the offer to the Directors in London, with an intimation that, if not accepted on or before the 30th of September, it was to be considered as withdrawn. This was agreed to.

The Finances of the Darwen Corporation.—The annual statement of accounts of the Darwen Corporation has been issued by Mr. Ellison, the Borough Treasurer. The gas-works account shows a gross profit of £9464; and, after making provision for annuities, interest on loans, and sinking fund requirements, there is a net profit of £724. The capital expenditure in the Electric Light Department is £7504. In the revenue account of the Water Department there is a gross profit of £6331; the net profit showing a gain of £799 on the year. At the end of March, the assets of the Corporation were £622,600, the liabilities £463,582.

Northampton Water Supply.—On Monday last week, the new filter-bed which has been in course of construction for the Northampton Corporation since May last year, under the supervision of their Water Engineer, Mr. John Eunson, was formally opened by the Mayor (Mr. F. Tonsley). The new bed covers an area of 23,000 superficial feet, while the total area of the other three is only 40,000 feet. The bottom is covered with rough stones, on which are placed smaller ones. On these is a layer of Leighton Buzzard silver sand to the depth of about 2 feet 3 inches, making the whole depth of filtering material about 3 feet 9 inches. The water goes through the present beds at the rate of about 6 inches an hour; but by the use of the new bed, in addition to the old ones, it will only go through at about 2 or 3 inches; so that by the slower method of working, much more efficient filtration will be obtained. The water flows from the reservoir into the filter-bed from a large perpendicular pipe some 8 or 10 feet high. It falls as from a large fountain, and is thus aërated. The contract for the erection of the stonework amounted to £3000. A large party was invited by Mr. J. Jackson, the Chairman of the Water Committee, to be present at the ceremony.

Manchester Water Supply.—At a meeting of the Water Committee of the Manchester Corporation last Thursday a deputation was received from the District Councils of Atherton and Tyldesley. This district is supplied by the Corporation; and the object of the deputation was to lay before the Committee a complaint that the pressure of water is insufficient. They represented that, in consequence of the low pressure, much inconvenience is felt both by occupiers of houses and employers of labour. They pointed out that a fire might be attended with disastrous consequences. The main which conveys Thirlmere water to Manchester passes within a reasonable distance of the area governed by the two Authorities; and the deputation suggested that it should be tapped. The Water Committee pointed out that there is no agreement to supply water at a given pressure. The water passes from Irlams-o'-th'-Height through Eccles to Worsley, where it is delivered to Tyldesley, which district supplies Atherton. Preparations have been made for laying an additional 15-inch main from Irlams-o'-th'-Height along Eccles Old Road to Eccles, and the work will be commenced in a few days. The new main will give a better supply to Eccles and district; and the Committee have reason to believe that the improvement will also extend to Tyldesley and Atherton. It was reported that last Wednesday there was a record consumption of water. The figures were 39,800,000 gallons. The 39,000,000 mark has been passed more than once, but never before has the consumption so nearly reached 40,000,000 gallons.

JOSEPH AIRD
GREAT-BRIDGE.
STAFFORDSHIRE.
TUBES
AND FITTINGS
Illustrated Price Lists on Application.
LONDON OFFICES: 46, QUEEN VICTORIA STREET, E.C.

Increase in Price.—The Kirriemuir Gas Company have raised the price of gas 2½d. per 1000 cubic feet, in consequence of the high price of coal.

Village Lighting by Acetylene.—St. Michael's, a village within the Borough of Tenterden, Kent, has just been lighted by acetylene; the installation consisting of 80 burners of 25-candle power each.

Seville Water-Works Company, Limited.—The annual meeting of this Company was held last Friday, under the presidency of Mr. David Evans. The report showed that the income amounted to £27,597; but the net profit was only £8680, as compared with £10,106 in the preceding year. The undivided profit, however, made the sum at the credit of the profit and loss account £17,641. The Directors recommended the addition of £374 to the reserve fund, and the payment of a dividend of 2 per cent.—leaving a balance of £11,844 to be carried forward. The report also pointed out several circumstances which had adversely affected the Company—particularly the high rate of exchange in the first half of the financial year, which more than counterbalanced a satisfactory increase in the water-rentals. However, the rate had now considerably improved; and it was hoped the present year would be a more favourable one for the Company. The Chairman, moving the adoption of the report, explained that the net profit would admit of a dividend of 3 per cent.; but the indifference of the Municipality to the payment of their debts kept the Company short of the necessary funds wherewith to pay it. The report of their Engineer informed them of the difficult time through which they were passing. Exchange had been so adverse that, if the business had not been intrinsically good, that alone would have eaten up the profits. But to the drawback of the exchange had to be added the extremely high price they had had to pay for fuel, and the difficulty on account of the drought of obtaining water. Under all the circumstances, the Directors thought it wise not to distribute more than 2 per cent. Much of their trouble had arisen from the way in which they had been treated by the Municipality. Had the latter only carried out the stipulations, and handed over the St. Lucia spring, they would have enabled the Company to amply supply their customers with water. The failure of the Municipality to do so had forced them into a large and, in some measure, useless expenditure. The Company had invariably studied the interests of the inhabitants rather than the pockets of the shareholders; and it was a matter of regret that the Sevillians, knowing how few were the sources from which water could be obtained, did not aid the Company in getting a spring which was clearly theirs, and on the water from which they depended so much to satisfactorily fulfil their contracts. The report was unanimously adopted. Senor Don Tiburcio Castaneda (who, having an intimate knowledge of affairs in Seville, will be of the greatest assistance to the Board) was elected a Director.

Messrs. Biggs, Wall, and Co. have just secured an order from South America for about 750 tons of cast-iron pipes.

The tender of Messrs. Clayton, Son, and Co., Limited, has been accepted for a double-lift gasholder for the Settle Gas Company, to be constructed to the designs of Mr. John Waugh, of Bradford, the Company's Engineer. Mr. C. Metcalfe, of Nelson, has obtained the contract for the tank. The holder is to be completed by Oct. 30.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.
JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to the Company as above.

WINKLEMANN'S ORIGINAL "VOLCANIC" FIRE CEMENT and "VOLCUM" PASTE. Always ready for use in GAS-WORKS. Resists 4500° Fahr.
ANDREW STEPHENSON,
162, Palmerston Buildings,
Old Broad Street, E.C.
"Volcanism, London."

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see July 4, p. 74.]

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

SPENT OXIDE wanted.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

MELROSE CYCLES

SHOULD be bought by Gas and Water Officials. Ladies' No. 1, £10 10s.; No. 2, £8 10s. Gents' No. 1, £10; No. 2, £8. Highest Quality. Twelve Months' Guaranty. Sent on approval. Catalogue free. MELROSE CYCLE COMPANY, COVENTRY.

PATENTS FOR INVENTIONS.
Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

IRON OXIDE (Bog Ore), best quality, for the Purification of Gas, containing up to 85 per cent. Hydrated Oxide of Iron, and absorbing while being used a high percentage of Blue.
S. BOWLEY AND SON, Wellington Works, Battersea Bridge, LONDON, S.W.

BENZOL, specially made for the Enrich- ment of Gas.
ELLISON AND MITCHELL, LIMITED, Kilnhurst, near ROTHERHAM.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BARMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

PRACTICAL RETORT SETTER.

GEORGE NUTTALL, 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SHEFFIELD CHEMICAL COMPANY, LIMITED.

BUYERS of Spent Oxide. Sellers of OXIDE OF IRON and SULPHURIC ACID.

WANTED, Two Leading Stokers, accustomed to Regenerative Settings and West's Machine Stoking. For Steady, reliable Men, position permanent.
Apply, by letter, stating Age, References, and Wages expected, to No. 3311, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Foreman of Works. Good Carbonizer, able to lay Mains and Services, fix Meters, Stoves, Incandescent Fittings and work Iron and Compo., also Blacksmithing. Wages 25s. weekly. House, Garden, Coal, and Gas in addition.
Apply, by letter, to No. 3308, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SEASON 1899.

BALE'S OXIDE OF IRON, of finest Quality. Summer delivery specially recommended for efficiency and economy.
FIRE CEMENT, PAINT, and CHEMICALS.
120 and 121, NEWGATE STREET, LONDON, E.C.

SADLER & CO., Ltd., Middlesbrough, Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

WANTED, a Situation as Working MANAGER of a Small Gas-Works, making up to 6 millions. Seven Years' Reference from last place, and Two Years' from present one. Excellent Testimonials. Change desired.
Address No. 3313, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a few good Retort Setters. Applications to the GAS ENGINEER, Bradford, YORKSHIRE.

WANTED, Gas Stokers. Permanency to suitable Men. Wages 28s. weekly.
Apply to the MANAGER, Gas-Works, Pembroke Dock, SOUTH WALES.

WORTHING GAS COMPANY.

STOKERS and Coalwheelers wanted immediately. Wages 5s. and 4s. per Shift.
Apply, with References, to the MANAGER, Gas-Works, WORTHING.

STOKER wanted immediately for Works in Suffolk. Shovel Charging. Wages 18s., and Cottage, Fire, and Gas. Abstainer preferred.
Apply, by letter, to No. 3314, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TRAVELLER wanted, with first-class connection among Gas Companies in North of England, to represent a Firm of Meter Makers.
Apply, by letter, to No. 3312, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS-METER TRADE.

WANTED, a thoroughly capable Works MANAGER, to take charge of Meter-Works. A good and permanent Situation for a capable Man.
Apply SECRETARY, John Wright and Co., Limited, Essex Works, BIRMINGHAM, giving full Particulars of previous Engagements, Age, Salary, &c. Any Communication will be treated in strict confidence.

NIGHT FOREMAN FOR RETORT-HOUSE.

WANTED, at a Gas-Works in the neighbourhood of Manchester, a RETORT-HOUSE FOREMAN for Night Duty. Must be under 40 Years of Age, and thoroughly experienced in the working of Regenerative Furnaces. Wages £2 per week.
Apply, by letter, stating Age, previous Experience, with References, to No. 3315, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RETORT-HOUSE Foreman wanted at once. Applicants must have had practical experience of the working of Regenerative Furnaces, and the modern methods of Carbonizing. Wages £2 2s. per week.

Apply, by letter only, stating Age, &c., to the MANAGER, Gas-Works, CAMBRIDGE.

HIGH WYCOMBE GASLIGHT AND COKE COMPANY, LIMITED.

WANTED, a Gas-Fitter by the above Company. One accustomed to Ordinary and Slot Work (Compo. and Iron). Constant work to a thoroughly capable, reliable, and energetic Man. Age about 35. Wages 30s. per week.

Apply, with Testimonials, to the undersigned.

J. FRED. WICKS, C.E.,
Engineer and Secretary.

GAS MANAGER.

THE Directors of the Airedale Gas Company require the services of a thoroughly competent and reliable Man as MANAGER. Salary £130 per annum, with House, Coal, Gas, &c., free. Annual make, about 35 millions.

Applications, with not more than three recent Testimonials of Character and Ability, to be forwarded to the undersigned not later than Monday, the 31st day of July, 1899.

By order,
EDWIN THORNTON,
Secretary.

Gas Office, Idle, near Bradford,
July 19, 1899.

NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

DISTRIBUTION SUPERINTENDENT.

THE Directors of the above Company invite applications for the position of DISTRIBUTION SUPERINTENDENT under the Engineer. Candidates must have had a good general and technical Education and Experience in the Distribution Department of a Gas Undertaking. The Salary will commence at £225 per annum.

Applications, endorsed "Distribution Superintendent," stating Age, Experience, present Employment, &c., accompanied by *copies* of not more than three recent Testimonials, to be sent in to the undersigned on or before the 8th day of August, 1899.

(Signed) THOS. WADDOM,
Secretary.

Gas Offices, Newcastle-upon-Tyne,
July 20, 1899.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

COUNTY BOROUGH OF WIGAN.

FOR SALE—Two good Second-hand PURIFIERS, and TRAVELLING LIFTING APPARATUS, capacity 20 ft. by 20 ft. by 4 ft. 6 in. May be seen on application to

J. TIMMINS,
Engineer.

Borough Gas-Works, Wigan,
July 21, 1899.

STATION METER FOR SALE.

OFFERS invited for Station Meter to be removed next October, after the fixing of a new one rendered necessary by the enlargement of Works. Six-inch connections; 5000 cubic feet per hour.

Apply to the undersigned.

D. H. JONES,
Borough Accountant.

Guildhall, Carnarvon.

FOR SALE, cheap—

Two PURIFIERS, 5 ft. square by 4 ft. deep.
One " 5 ft. " 3 ft. "
One EXHAUSTER, 20,000 Cubic Feet per hour.
Two " 5000 " "
Also CONDENSERS, SCRUBBERS, WASHERS GASHOLDERS and TANKS, VALVES, &c., &c.

Apply to SAML. WHILE AND SON, 60, Queen Victoria Street, LONDON, E.C.

FOR SALE—Forty Cast-Iron Mouth- PIECES, with Self-Sealing Lids, 18 in. by 15½ in. at back, 18 in. by 13 in. at front; Off-Takes in various positions.

Also One (Waller) TWO-BLADE GAS EXHAUSTER, capable of passing about 30,000 Cubic Feet per hour, with 12-inch Valves, but without Engine.

Price and further Particulars may be had from

J. D. ASHWORTH,
Engineer.

Gas-Works, Portsmouth.

FOR SALE, cheap to clear—

TOWER SCRUBBER (Walker), 5 ft. by 25 ft. high, complete.
STATION METER, 8-inch, complete and perfect.
EXHAUSTER and ENGINE, combined (Waller), 9-inch Valves, Governors, &c., complete.
GASHOLDER, 35 ft. by 14 ft. deep, only Six Years old.
CAST-IRON TANK, 31 ft. dia., 12 ft. deep, nearly new; cheap to immediate Purchaser.
Four 10-feet PURIFIERS, Centre-Valve and Connections; all good and cheap.
EXHAUSTERS, sizes from 4000 to 30,000 Cubic Feet per hour, in stock.

If sold this month accept any reasonable offer.

J. FORTH BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

WANTED, for a small Gas-Works, a second-hand GASHOLDER.

Full Particulars as to Size, Condition, Price, &c., to be sent to the SECRETARY, Sturminster Gas and Coke Company, Limited, Sturminster, Newton, DORSET.

HAWORTH URBAN DISTRICT COUNCIL.

THE above Council invite Tenders for the supply of 2000 Tons of unscreened GAS COAL, delivered at Haworth Railway Station.

Sealed Tenders to be sent to me, the undersigned, marked "Coal Tender," not later than Thursday, the 27th of July.

WM. ROBERTSHAW,
Clerk to the Council

Burlington Chambers, Keighley.

LEIGH URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Gas Committee of the above Council invite TENDERS for the supply of GAS COAL and CANNEL for a period of Twelve Months.

Forms of Tender and further Particulars may be obtained on application to the Manager, Mr. John Foster, Gas-Works, Leigh.

Tenders to be sealed and delivered to me the undersigned on or before Twelve o'clock noon, on Wednesday, the 2nd day of August, 1899.

By order,
PEREGRINE THOMAS,
Clerk and Solicitor.

Town Hall, Leigh, Lancs.,
July 18, 1899.

GAS-MAINS AND LAYING.

TENDERS are desired by the Bakewell Urban District Council for the following Contracts:—

No. 1—Supply of about 1400 yards of CAST-IRON GAS-MAINS, with SPECIAL CONNECTIONS.
No. 2—LAYING ABOVE, including necessary MATERIALS.
No. 3—EXCAVATING AND FILLING UP TRENCHES.

Particulars and Forms obtainable from Mr. T. W. Tiplady, Manager.

Separate and sealed Tenders, marked "Tender for Gas-Main," must reach the undersigned on or before the 7th of August prox.

VERNON R. COCKERTON,
Clerk.

Bakewell.

BOROUGH OF DEWSBURY.

THE Lighting and Water Committee of the above Corporation invite TENDERS for the supply and delivery during the Twelve Months ending the 31st day of August, 1900, of

1. SULPHURIC ACID.
2. WET AND DRY GAS-METERS.
3. CAST-IRON GAS AND WATER PIPES.

Specification and Forms of Tender may be obtained on application to the Gas Engineer, Mr. Chas. A. Craven, Gas-Works, Savile Town, Dewsbury.

Tenders, under sealed covers, endorsed "Sulphuric Acid," "Meters," or "Cast-Iron Pipes," as the case may be, to be sent to me not later than Saturday, the 29th inst.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
G. TREVELYAN LEE,
Town Clerk.

Town Hall, Dewsbury.

THE Perth Gas Commissioners are pre- pared to receive TENDERS for the execution of the following Contracts in connection with the erection of their new Gas-Works at the Friarton, Perth—viz.,

SECTION I.—EXCAVATOR, BRICKWORK, &c.
SECTION II.—CARPENTER and JOINER.
SECTION III.—SLATER.
SECTION IV.—PLUMBER.
SECTION V.—PLASTERER.
SECTION VI.—PAINTER.
SECTION VII.—GLAZIER.

Schedules may be obtained on and after the 26th of July curt. from Mr. William Campbell, Ordained Measurer, 32, North Methven Street, Perth, at whose Office the Drawings may be seen from the 26th till the 29th of July curt.

The Drawings may also be seen at the Office of Mr. A. Gillespie, Engineer, 34, St. Enoch Square, Glasgow, from the 31st of July curt. till the 5th of August next.

Tenders to be delivered to the undersigned not later than the 7th of August next, endorsed "Tender for New Gas-Works."

WM. MACLEISH,
Clerk to Gas Commissioners.

City Chambers, Perth,
July 15, 1899.

WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

TO GASHOLDER MAKERS.

THE Directors of the above Company are prepared to receive TENDERS for the supply and erection of a THREE-LIFT TELESCOPIC STEEL GASHOLDER, 145 feet in diameter.

Copies of Specification and Prints of Drawings may be obtained on application to the undersigned on payment of £2 2s., which amount will be returned on receipt of a *bonâ-fide* Tender, and the return of the Specification and Drawings in the event of non-acceptance of the same.

Sealed Tenders, addressed to the Chairman of the Company, and endorsed on cover "Tender for Gasholder," to be delivered at this Office by Noon on Monday, Aug. 14, 1899.

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
H. H. JONES,
Engineer and Manager.

Gas-Works, North Street,
Wandsworth, S.W.,
July 13, 1899.

RAMSBOTTOM GAS COMPANY.

THE Directors of the above Company are open to receive TENDERS for the purchase of their surplus TAR and AMMONIACIAL LIQUOR, free on Rail in Purchaser's Tanks, for One Year ending June 30, 1900.

Forms of Tender may be obtained on application to the undersigned.

Sealed Tenders to be sent to the Chairman on or before Aug. 1, and endorsed "Tar and Liquor."

F. BARRETT,
Manager and Secretary.

Gas-Works, Ramsbottom.

ABERYSTWYTH GAS COMPANY.

THE Aberystwyth Gas Company invite TENDERS for the supply and erection of Four PURIFIERS, Two ENGINES, and EXHAUSTERS.

Sealed and endorsed Tenders must be addressed to the Chairman, and delivered on or before the 29th inst.

Plans and Specifications may be had on application to Mr. H. Woodall, Queen Anne's Mansions, St. James's Park, S.W.

The Committee do not bind themselves to accept the lowest or any Tender.

K. J. JONES,
Secretary.

OSWALDTWISTLE URBAN DISTRICT COUNCIL.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at their Works for One Year from the 31st day of July, 1899.

The quantity of Coal carbonized is about 3700 Tons.

Further Particulars may be obtained from the Manager, Gas-Works, Church, near Accrington.

Tenders, endorsed "Tender for Tar," to be addressed to me, and to be delivered not later than Wednesday, the 2nd of August.

WM. SANDEMAN,
Clerk.

District Council Offices,
Oswaldtwistle,
July 14, 1899.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors in this Company will be held at this Office, on Friday, the 4th day of August next, at Twelve o'clock (noon) precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending on the 30th day of June last.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., July 18, 1899.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Offices, No. 63, Chancery Lane, in the County of Middlesex, on Friday, the 11th day of August, 1899, at Half-past Three o'clock in the afternoon precisely, to receive the Report of the Directors and the Accounts for the Half Year ended the 30th of June last, to declare Dividends, and to transact the Ordinary Business of a General Meeting.

The TRANSFER BOOKS WILL BE CLOSED from the 26th of July to the 11th of August, both inclusive.

By order of the Board,
S. J. WILLIAMS,
Secretary.

Offices: 63, Chancery Lane,
London, W.C., July 22, 1899.

CRYSTAL PALACE DISTRICT GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Albion Tavern, Aldersgate Street London, E.C., on Friday, the 4th day of August, 1899, at Three o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ended the 30th of June last, to declare a Dividend for the same period, and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from the 20th day of July, until after the Meeting.

By order of the Board,
CHARLES M. OHREN,
Secretary.

Offices and Works:
Lower Sydenham, S.E.,
July 17, 1899.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.

GAS ENGINEERS' AGENTS AND CONTRACTORS FOR

Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.

Inquiries Solicited.

Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

Foolscap 4to, pp. 535, with 239 Illustrations and Steel Plate Engraving (as Frontispiece) of WILLIAM MURDOCH, *Inventor of Gas Lighting. Morocco Gilt, 21s.; Roan Gilt, 18s.*

THE SIXTH (AND CENTENARY) EDITION
OF THE

HANDBOOK
FOR
GAS ENGINEERS AND MANAGERS.

BY
THOMAS NEWBIGGING,
M.Inst.C.E.

LONDON:
WALTER KING, 11, BOLT COURT,
FLEET STREET, E.C.

NITRATE of Thorium and Cerium. FABRIK CHEMISCHER PRAEPARATE VON STHAMER, NOACK, AND CO., HAMBURG.

ENRICH YOUR GAS
WITH CHEAP
BENZOL,
SPECIALLY PREPARED, FREE FROM SULPHUR,
AT to-day's Price of Benzol, Illuminating POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.
Apply to SADLER & CO., MIDDLESBROUGH.

DISPENSE WITH CANNEL COAL
and
INCREASE YOUR ILLUMINATING POWER
by using the
WHESSOE-MUNICH BENZOL CARBURETTER
The Cheapest and Best in the Market.
The Managers of Tynemouth, Middlesbrough, and Darlington Gas-Works are much pleased with it, and would not be without it.
Apply to the Sole Makers
THE WHESSOE FOUNDRY COMPANY, LIMITED,
DARLINGTON.

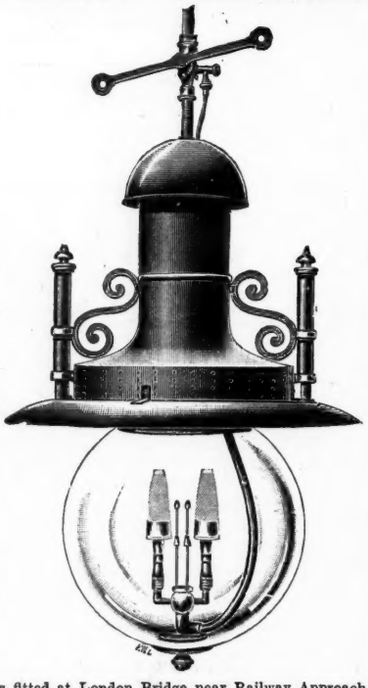
THOMAS TURTON
AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS,
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

JAMES OAKES & CO.
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH N.B.

THE PATENT
"BEACON" GLOBE LAMP.



As fitted at London Bridge near Railway Approach, three Lamps giving the Illuminating Power of 600 Candles. See Surveyor's Report as published in the "*JOURNAL*" for Jan. 10, 1899.

H. GREENE & SONS, Ld.,
Late of Cannon Street,
19, FARRINGDON RD., E.C.
Telegrams: "LUMINOSITY, LONDON."

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.
For Particulars, Price, &c., apply to MR. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.
Prices are Reduced.

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
With Elevators and Conveyors worked by Steam or Gas Engine.
GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.;
And at STROUD, GLOUCESTERSHIRE.

WELDON MUD
FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.
Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— *LIMITED,* —
1, FENCHURCH AVENUE, LONDON, E.C.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,
for
CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton. .	10,500 Cubic Feet.
Illuminating Power . .	16·9 Candles.
Coke	66·7 Coke.
Sulphur	0·86 Sulphur.
Ash	2·04 Ash.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.
Telegraphic Address: "PARKINSON, NEWCASTLE."

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

HOLMSIDE
GAS COALS.
Present Daily Produce over 5000 Tons.
Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

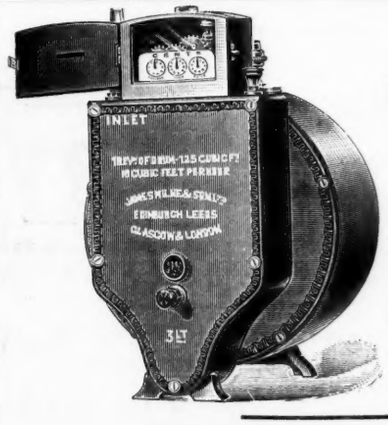
HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.
Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.
Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.
These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

RECOVERY OF SPENT LIMES.

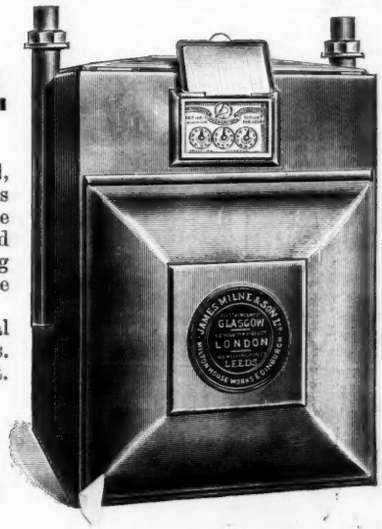
G. R. HISLOP'S Patent Improved Lime Revivifying Apparatus.

SPENT LIME as carbonate is RESTORED at a cost considerably under that of New Lime, and that WITHOUT LIMIT to its DURABILITY, and with UNIMPAIRED EFFICACY as a Purifying Agent. The LIME is RESTORED on the PREMISES; ECONOMY of SPACE is SECURED by the non-accumulation of Spent Lime—thus SAVING all TROUBLE and EXPENSE in the disposal of the Lime as waste. The PROCESS can be USED in any LOCALITY without becoming a nuisance. Enquiries respectfully solicited. Full Particulars from Messrs. SAMUEL WHILE & SON, 60, Queen Victoria Street, LONDON, E.C.; or from the Principal Agent, R. F. HISLOP, F.C.S., Gas Engineer, Craigielea, PAISLEY.



MILNE'S
WET & DRY GAS-METER.

These Wet Meters are still preferred, in many cases, to Compensating Meters on account of the long time they can be left without re-watering; the improved construction and shape allowing a long range of water-line without affecting the registration.
Dry Meters of Special Charcoal Tinned Iron, with many Improvements. Extra Thick Tin Plate used throughout.



JAMES MILNE & SON, LTD.
MILTON HOUSE WORKS **EDINBURGH.**
60 HOLBORN VIADUCT **LONDON.** | 111 ST. VINCENT STREET **GLASGOW.** | 48 WELLINGTON STREET **LEEDS.**

HARRIS & PEARSON,

STOURBRIDGE, ENGLAND,

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.

MAURICE GRAHAM,
Managing-Director.

Telegrams:
"ACCOUPLE, LEEDS."

GRAHAM, MORTON, & CO.

— LIMITED —

INCLINED RETORTS

AND ALL CLASSES OF

ELEVATING & CONVEYING MACHINERY

— Contractors to Her Majesty's Government. —

LEEDS.

LONDON OFFICE:

34, VICTORIA ST., WESTMINSTER, S.W.

TELEGRAPHIC ADDRESSES
"DRAKESON HALIFAX."
"ECLAIRAGE LONDON."

TELEPHONE No. 43.
"HALIFAX EXCHANGE"

GAS ENGINEERS.
CONTRACTORS.
IRONFOUNDERS.

JONAS DRAKE & SON

SOLE AGENTS FOR

HISLOP'S

PATENT REGENERATIVE FURNACES
— FOR —
ENGLAND, WALES & ABROAD.

RETORT BENCHES ERECTED COMPLETE
WITH OR WITHOUT SPECIAL FURNACES.
RESULTS GUARANTEED.

OVENDEN HALIFAX

RETORT SETTERS.
FURNACE BUILDERS.
ETC. ETC.

Designs and Estimates on Application.

GASEOUS FIRING A SPECIALTY.

MOBBERLEY & PERRY

STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c. &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

London Agents: Contractors for the erection of Retort-Benches complete.

BALE & HARDY, Gas Engineers and Contractors, BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

OIL FOR GAS MAKING

PURE DISTILLATE.

HOMOGENEOUS IN CHARACTER.

NO MIXTURE.

CAN BE STORED SAFELY ANYWHERE.

FLASH POINT GUARANTEED OVER 200° FAHR.

(ABEL'S CLOSED TEST.)

ANGLO-CAUCASIAN OIL COMPANY, LTD.

8, 9, 10, & 11, LIME STREET, LONDON, E.C. | INDIA BUILDINGS, CROSS ST., MANCHESTER.

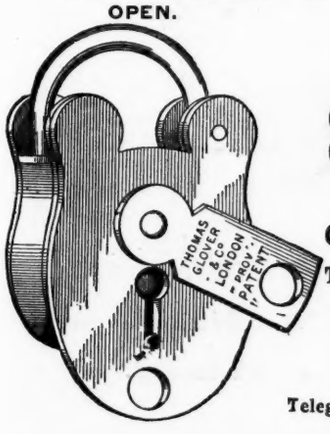
ESTABLISHED 1844. **ORIGINAL MAKERS.** ESTABLISHED 1844.

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;

The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.

OPEN.



THOMAS GLOVER & CO.'S

PATENT

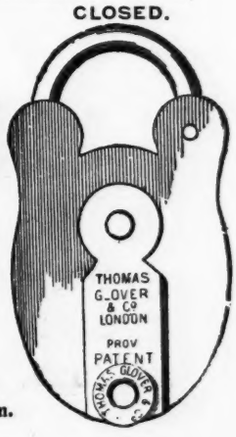
SECURE PADLOCK

PREVENTS TAMPERING WITH THE

CASH-BOXES OF PREPAYMENT METERS.

The Padlock is Sealed by means of a Lead Eyelet, which is impressed with Company's private mark. Eyelets easily fixed and removed by Company's Collector.

CLOSED.



Telegraphic Address: "GOTHIC, LONDON." Telephone No. 725, Holborn.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN, LONDON, E.C.

BRISTOL: 28, BATH STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 1005.

BIRMINGHAM: 1, OOZELLS STREET. *Telegraphic Address:* "GOTHIC."

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 8393.

GLASGOW: ARGYLE WORKS, KINNING PARK. *Telegraphic Address:* "GASMAIN." Telephone No. 1328 South Side.

EVERED & CO., LTD.,

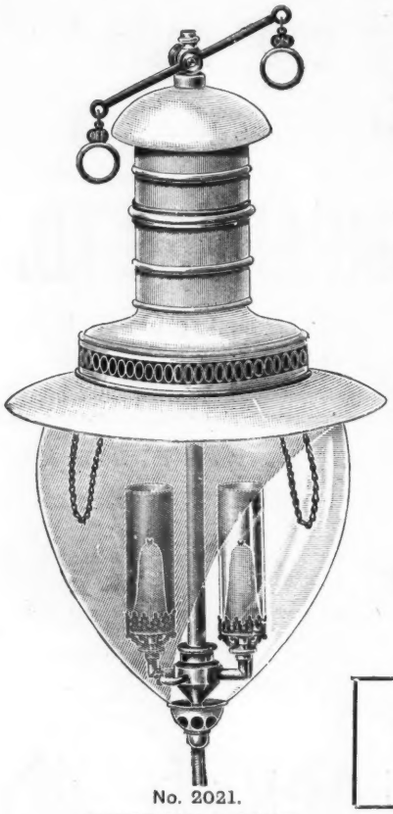
27 TO 35, DRURY LANE, LONDON.
SURREY WORKS, SMETHWICK.
BARNET WORKS, BIRMINGHAM.

Gas-Fittings Manufactory—SURREY WORKS, SMETHWICK.

THE

NEW "DRURY" SHOP LAMP

For Inside and Outside Lighting.



No. 2021.
WINDOW LIGHT.

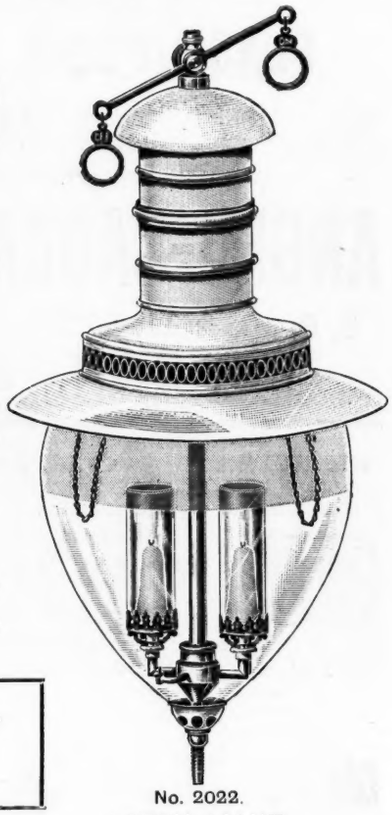
NEATLY ENAMELLED
IN FAWN COLOUR WITH
WHITE AND GOLD RELIEF.

No. 2020 is for Inside Lighting, with clear flint Globe.

No. 2021 is for Window Lighting, and has a diagonally obscured Globe.

No. 2022 is for Lobby Lighting, and has an opal top Globe.

A similar Lamp made for Electric Light.



No. 2022.
LOBBY LIGHT.

Prices:—

	1-Light.	2-Light.	3 Light.
No. 2020	40s. 6d.	52s. 6d.	58s. 6d. each.
No. 2021	42s. 6d.	55s. 6d.	61s. 6d. „
No. 2022	50s. 9d.	66s. Od.	72s. Od. „

Subject to Trade Discount.

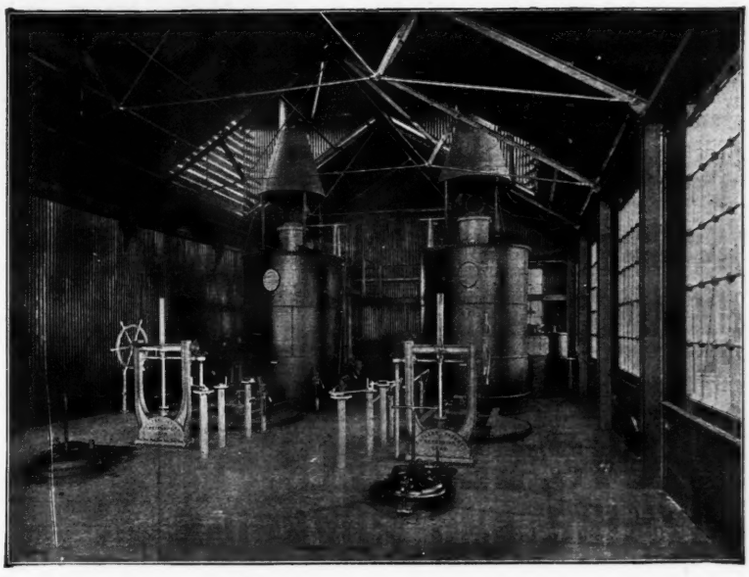
MANUFACTURERS OF

Gas Joints in every form suitable to the requirements of Gas Companies and the Trade generally.

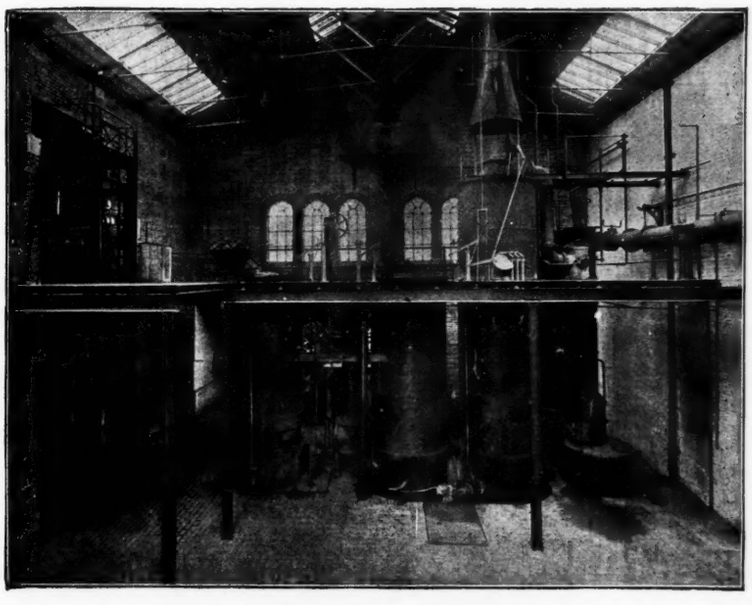
S. Cutler & Sons,
Millwall, London.

GASHOLDERS.

CARBURETTED WATER-GAS PLANT.



Water-Gas Plant at Southall.



Water-Gas Plant at Folkestone.

Carburetted Water-Gas Installations.

HORNSEY.
HASTINGS.
BUENOS AYRES.
SOUTHEND.
PLYMOUTH.
SOUTHALL.
HARROW.
HORSHAM.
FOLKESTONE.
BEXHILL.

SOUTHEND (2nd Order).
PLYMOUTH (2nd Order).
SOUTHALL (2nd Order).
FOLKESTONE (2nd Order).

CUTLER'S PATENT GUIDE-FRAMING FOR GASHOLDERS

ADOPTED FOR
MANY IMPORTANT
GASHOLDERS.

OIL-TANKS.

EVERY DESCRIPTION OF
GAS-WORKS APPARATUS.

Water-Gas Plant at Southend.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

THE THAMES BANK IRON CO.

UPPER GROUND STREET, LONDON, S.E.,

SUPPLY FROM STOCK

CAST-IRON RETORTS

AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS.

AGENTS FOR

ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

G. & J. HAIGH,

Raven's Lodge Fire-Brick Works, DEWSBURY.

Manufacturers of MACHINE-MADE RETORTS and

FIRE-BRICKS of the highest Quality, made from Fire-Clay of a most Superior and Refractory Character suitable for GLASS-WORKS, GAS-WORKS, and BLAST-FURNACES.

For Prices and Analysis, apply as above.

Telegrams: "Robustness, London."

RETORT-HOUSE, SETTINGS, & RAILWAY

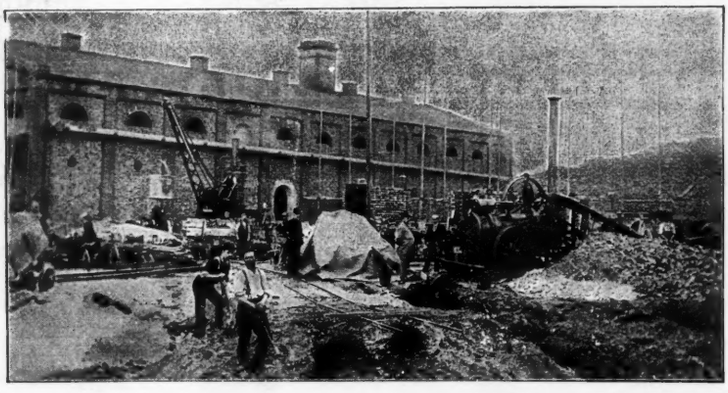
IN COURSE OF ERECTION BY OUR OWN WORKMEN.

Telephone: No. 756 Bank.

Plans, Estimates, and Specifications prepared and submitted.

Special Facilities for RECONSTRUCTING GAS-WORKS.

CONDENSERS, SCRUBBERS, WASHERS, EXHAUSTERS, TANKS, and every REQUISITE.



A SPECIALITY.

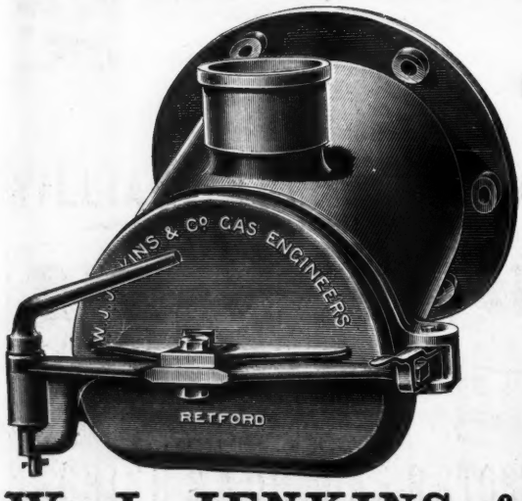
INCLINED and FLOOR-LEVEL SETTINGS with or without REGENERATIVE or GENERATOR FURNACES, with or without IRONWORK. COMPLETE RE-SETTING.

J. & H. ROBUS, Engineers and Contractors, 20, BUCKLERSBURY, LONDON, E.C.

GASHOLDER TANKS AND MAIN LAYING.

MOUTHPIECES

WITH SELF-SEALING LIDS FOR HORIZONTAL AND INCLINED RETORTS.



W. J. JENKINS & CO., LTD., RETFORD.

THE SUNLIGHT INCANDESCENT GAS-BURNER

Applications for **AGENCIES** now being received.

NOTE THESE FEATURES:

A1. WHITE MANTLES.
Longest Lived and Highest Candle Power.

'SUNLIGHT' TINTED MANTLES.
Strongest and Pleasantest Colour.

These are **INTERCHANGEABLE** on same Burner.

BURNERS WITH CHIMNEYS.
Cheapest in the Market.

CHIMNEYLESS BURNERS.
Cheapest, Simplest, and Most Efficient.

SELF-LIGHTER.
Only Efficient System.

A great sensation with this unique combination of features is promised to our Agents for the coming season. Any firm of standing, applying early enough, will be very favourably dealt with.

An early visit to the London Show-Rooms is especially solicited.

SPECIAL NOTICE.

Sunlight Tinted Mantles have been declared by the Courts to be "as far asunder as the Poles" from the Welsbach System, and we guarantee that our

SUNLIGHT WHITE MANTLES

are NO Infringement of that or any other Patent, and are made under a Series of Independent Patents, and by an entirely New Process.

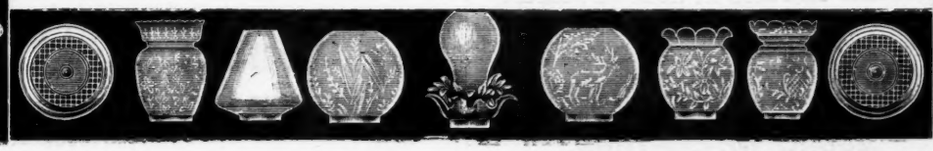
We give with every Mantle sold an absolute indemnity to both seller and user against all molestation on this account.

Price Lists, &c., on application.

New Sunlight Incandescent Co., Ltd.,

33 & 34, SHOE LANE, LONDON, E.C.

Telegrams: "IGNIFLUOUS." A.B.C. and A1. Codes used. Telephone: No. 947 Holborn.



BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.

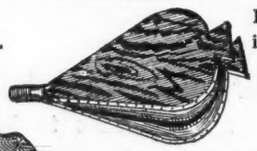
WILSON CARTER & PEARSON,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
ADDRESS CHIEF OFFICES:
Temple Buildings, 50, New Street, Birmingham.

ARROL-FOULIS
Patent Automatic Machinery
FOR
DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,
SIR WILLIAM ARROL & CO., Limited,
GLASGOW.
[See Illustrated Advertisement, July 4, p. 10.]

THOMAS BUGDEN,
Manufacturer of

Bellows for Inflating Gas-Bags. Made in various sizes.



Bellows made to inflate a 48-inch Bag under One Minute.

Miners' Woollen Jackets.

India-rubber Hose, Sheet, and Washers of every description, Leather Bands, Oils, &c., Diving and Wading Dresses, Waterproof Coats, Capes, and Sewer Boots.

Stokers' Mitts, from 14s. doz.

Special Air Tubing made for Gas Companies.

Gas-Bags for Mains.

71, GOSWELL ROAD, E.C., AND AT
256, PENTONVILLE ROAD, KING'S CROSS, N.

PETTIGREW'S PATENT
Sulphate of Ammonia Plant
ON THE CONTINUOUS SYSTEM
Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.
Old Systems easily and cheaply converted.
ANY SIZE ERECTED COMPLETE AT HOME OR ABROAD.
Makers of Self-Emptying Saturators.
Write for Particulars, Testimonials, and References to
GEO. PETTIGREW & Co.,
GAS AND CHEMICAL ENGINEERS,
MIDDLESBROUGH-ON-TEES.

THE
DENAYROUZE
LIGHT SYNDICATE,
THE
PIONEERS OF NO CHIMNEYS,

still hold their own on the market for the

HIGHEST CANDLE POWER

for each Cubic Foot of Gas at ordinary Pressures.

The Syndicate's Three-Light Cluster, governed to consume only 24 Cubic Feet of Gas per Hour, gives

550-CANDLE POWER,

which speaks for itself.

The Syndicate works under the

BANDSEPT PATENTS;

and Bandsept, who was the first to adopt the Injector Principle, is

STILL AHEAD OF ALL RIVALS;

and the combination of his Burners with Welsbach Mantles can be fearlessly tested against any others

ON THE MARKET.

Call and see these Burners.
AT THE
OFFICES OF THE SYNDICATE,
28, VICTORIA STREET, S.W.
CHARLES EDWARD MASTERMAN,
General Manager.

HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

Manufacturers of Glasshouse Pots and Crucibles of every kind.
Established 1836.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.
WORTLEY, LEEDS.

LONDON OFFICES & DEPÔTS:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

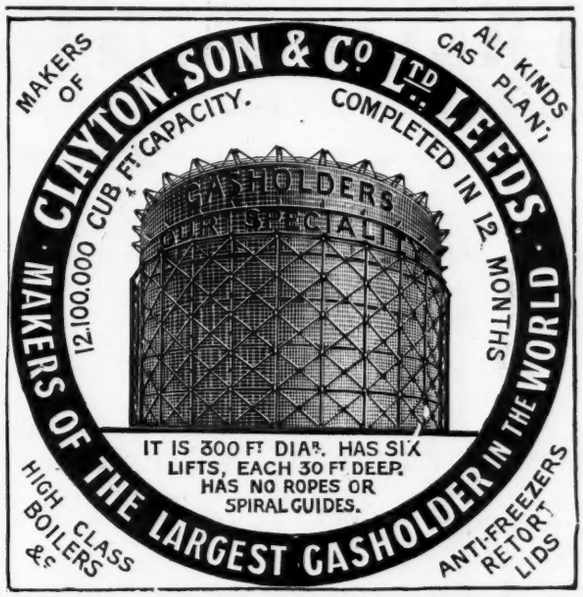
MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

MACKRELL BROS.,
Buslingthorpe Lane, LEEDS,
Manufacturers of
IMPROVED GAS-METER PERSIANS.

UNSURPASSED FOR QUALITY AND VALUE.


MAKERS OF
CLAYTON, SON & Co LTD LEEDS.
ALL KINDS GAS PLANT
COMPLETED IN 12 MONTHS
12,100,000 CUB FT CAPACITY.
GASHOLDERS
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
HIGH CLASS BOILERS &c
ANTI-FREEZERS RETORT LIDS

GIRDERS, ROOFS, & ALL KINDS OF STRUCTURAL IRONWORK.

London Office: 60, QUEEN VICTORIA STREET, E.C.
Telegraphic Addresses: "GAS, LEEDS." "ECLARAGE LONDON."

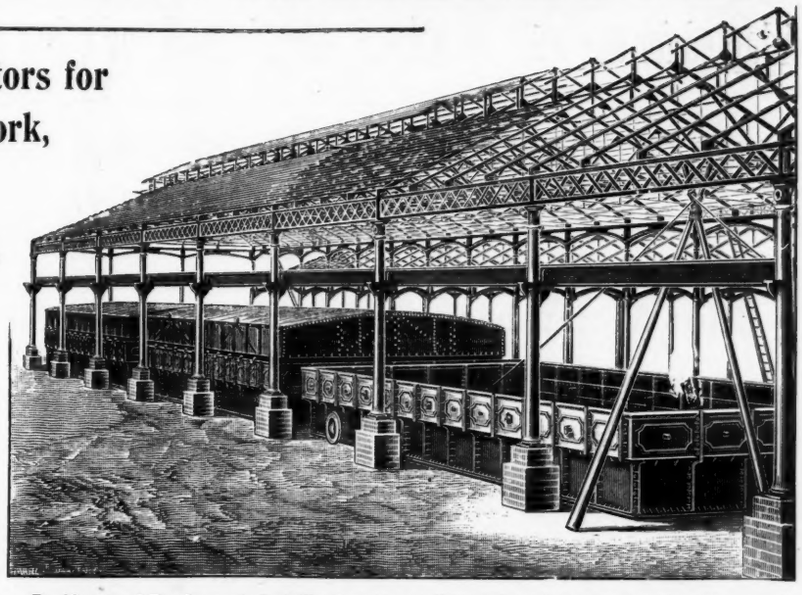
R. & J. DEMPSTER, LTD., GAS PLANT WORKS,

Telegraphic Address:
"SCRUBBER, MANCHESTER."
National Telephone
Nos. 54 and 2296.

NEWTON HEATH, MANCHESTER.

Engineers and Contractors for Construction Ironwork,

ROOFS, GIRDERS,
PURIFIERS, WASHERS,
SCRUBBERS,
CONDENSERS,
GASHOLDERS,
TANKS,
RETORT-MOUNTINGS,
VALVES, &c., &c.



Purifiers and Roofs erected at Windsor Street Works, Birmingham, to the Designs and under the supervision of C. HUNT, Esq., M.Inst.C.E.

London Office: 165, GRESHAM HOUSE, OLD BROAD STREET, E.C.

W. PARKINSON & Co.

PREPAYMENT GAS-METERS.

Many Thousands in use in all parts of the Country.

COMBINE SIMPLICITY WITH STRENGTH.

ACCURACY WITH COMPACTNESS.

Adapted for use with PENNIES, SHILLINGS, or other English or Foreign Coins.

PRICE-CHANGING EFFECTED IN THE SIMPLEST MANNER AND WITH ABSOLUTE EXACTITUDE.

Coin Mechanism accessible, and easily taken apart in case of ill-usage, &c.

GUARANTEED FOR FIVE YEARS.

COTTAGE LANE WORKS, CITY ROAD.

LONDON.

Telegrams: "INDEX." Telephone No. 778 King's Cross.

BELL BARN ROAD WORKS,

BIRMINGHAM.

Telegrams: 'GASMETERS." Telephone No. 1101.

[See also Advt. p 218.

LONDON: Printed by WALTER KING (at the Office of King, Sell, & Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London,—Tuesday, July 25, 1899.